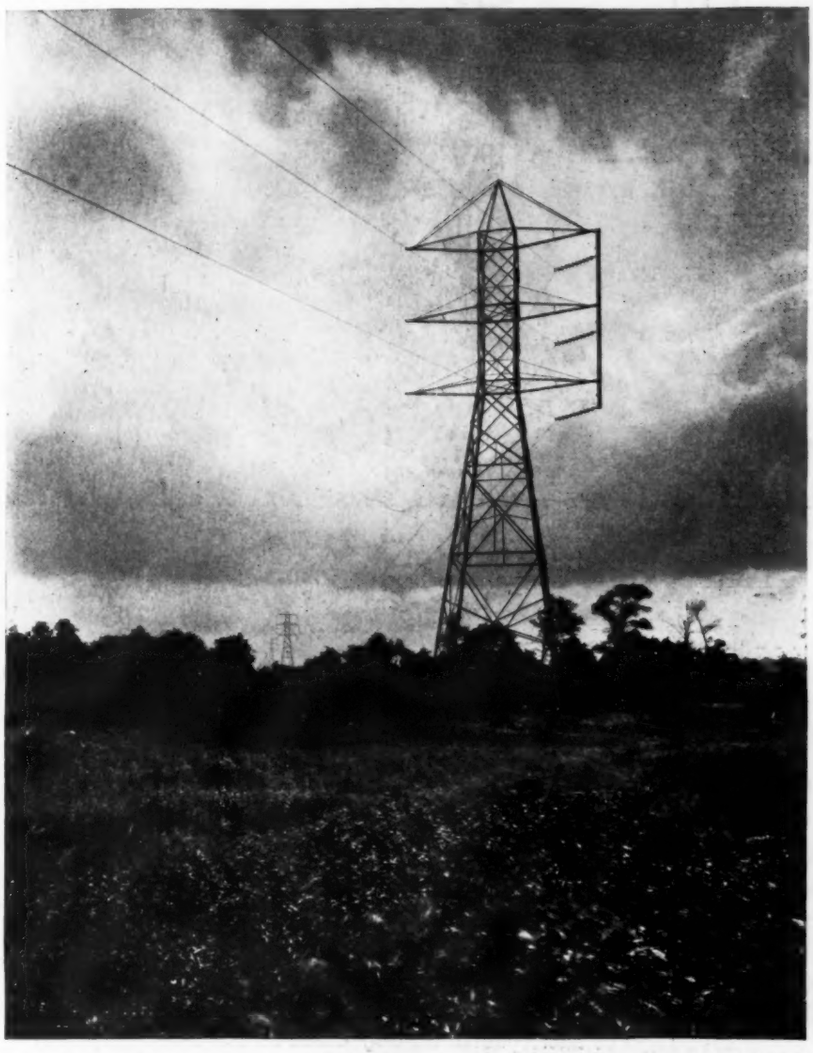
SEP 10 1923

Electrical World

McGraw-Hill Company, Inc.

Twenty-five Cents Per Copy

September 8, 1923



One of the angle towers used on the 132 kv. line of the Ohio Public Service Company. Interconnection plans are described in this issue.

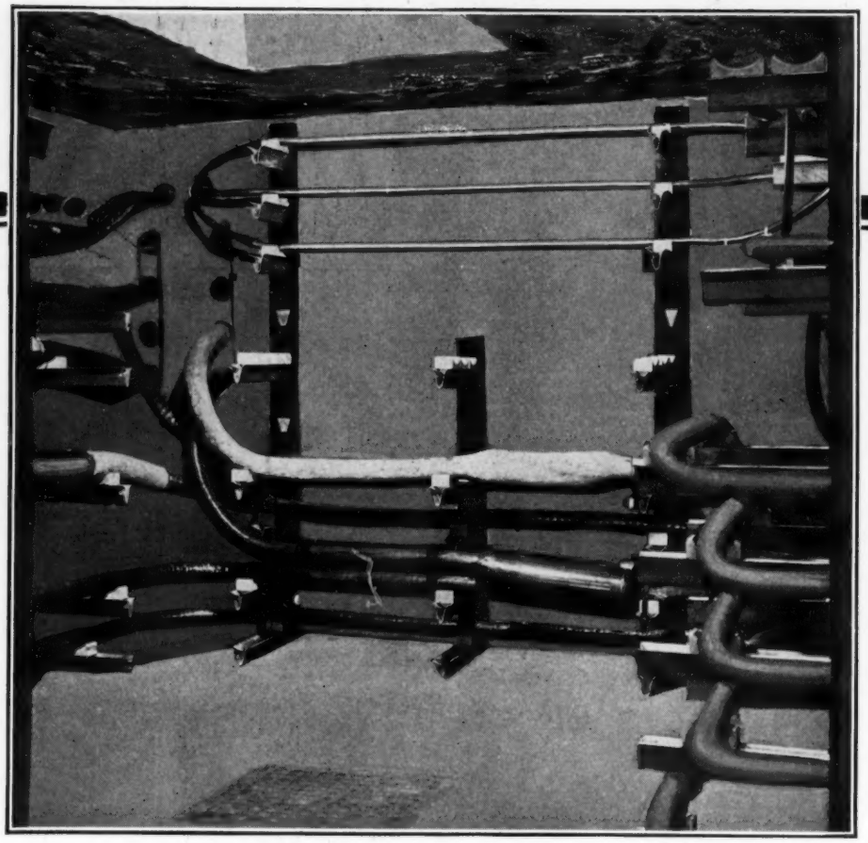
Interconnection in Ohio

Electric Furnaces for Foundries

Barometer Says Business is 10 per cent Above Normal

Construction Methods for Transmission Lines

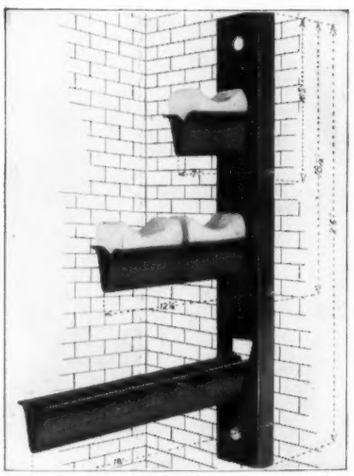
Boiler and Turbine Failures in England



Metropolitan Subway Cable Racks

are the racks being specified by the distribution engineers who are looking to the future.

And why? This is the only hanger in use which insulates the cable from the manhole proper. No chance for electrolysis. The porcelain insulator used in this device entirely prevents trouble from this source and makes it highly desirable for all power and signal cable requirements. The grooved hanger permits the porcelain insulator to be moved to any position of the cable. This is very important because of constant alterations due to extensions and improvements. Space does not allow us to list all the important advantages of Metropolitan Subway Cable racks. For full details, clip the coupon.



Metropolitan Subway Cable Rack with Porcelain Insulators

Other Metropolitan Safety Devices

Network Protectors
High and Low Tension Fuses
Junction Boxes
Standardized Switches
High Tension Cable Joints
Primary Cutouts
Subway Sectionalizing Units
D.C. Cable Testing Ammeters
High Tension Cable Joints
Cable Racks

METROPOLITAN DEVICE CORPORATION

1250 Atlantic Avenue, Brooklyn, N. Y.

Gentlemen:—Please send data and full information on Subway Cable Racks.

Name ..... Company .....

Address ..... Title .....

And kindly check any of the items at the left on which you desire information.

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR. Editor

HAROLD V. BOZELL Editor

Volume 82 New York, Saturday, September 8, 1923 *Number* 10

To Labor Less and Accomplish More

WHAT is actually the purpose to which the development of the electrical industry is working? What is it that step by step electrical men are forever striving to do? In a word, the entire intent is to provide new mechanisms and new opportunities whereby humanity may be enabled to accomplish more and labor less.

Every advance of applied electricity in the arts of peace creates a new means of doing something more efficiently, more easily or in some way better than before, if, indeed, it does not enrich the world with a fresh method of satisfying some need or by contributing a new service entire. Every forward step in illumination, in communication, in power or in electric heating application—every new achievement in design or operation—throws open the path toward doing the work of the world at large more easily.

THIS combination of increased service and lessened effort can be capitalized through an immense range of electrical applications from the microscope lamp to the biggest searchlight, from the tiny fan-driving element to the huge steel-mill motor, and from the smallest heating element to the largest electric furnace. It is beyond computation how much time and human effort have been saved by electric communication alone in the past few decades. It is a mere truism to point to the utter dependence of twentieth-century affairs upon multiplied electrical service, but this ubiquitous agency of increased accomplishment and reduced labor speeds on to greater triumphs, actually simplifying the existence of the average man, woman and child in the very faces of those who cry out that civilization is becoming too complex for human mentality and physical organisms.

If the user of modern mechanisms and systems of service were forced to understand them intimately, if the housewife at the washing machine could get no results without comprehending generator and turbine design, relay practice and transmission laws, it would be true that science had created a Juggernaut car bent upon destroying its votaries. But from the layman's standpoint the simple switch controls the local application so effectively that no thought of the complexities of the service it commands is required to enjoy perfect performance. Comprehension by the user is to be desired if it is voluntary, but it is to the lasting credit of engineers that a grasp of electrical technique is no part of the price which must be paid for the privilege of laboring less and accomplishing more by the use of the resources of this wonderful industry.

IT IS not surprising, therefore, that in the public mind the cost of service is held secondary in importance to quality of service. If actually no more work could be done by the use of electrical as against older methods, there would still remain the advantage of being able to perform the same volume of work better, as well as the attractions of easy manipulation. But since electricity accelerates production without loss of other advantages in innumerable fields, its appeal is simply irresistible. Its guaranteed capacity, as a burden bearer for humanity, is sweeping away every obstacle to its advance, and the scope of its future usefulness well-nigh transcends the powers of a sober imagination.

Charles Stetson Cook

A pioneer in transmission who later was largely instrumental in assuring the domination of electric power in the industrial district of Pittsburgh.

JUST thirty-one years ago a young Pittsburgh electrical engineer startled the world by successfully installing for 28 miles between San Antonio Canyon and San Bernardino, Cal., the first long-distance electrical transmission system in the United States carrying 10,000 volts. Today that same engineer, enriched by the wonderful activity and experience of a quarter century, is working out the problems concerned with placing Pittsburgh above any other city in the world as a center of electrical power in industrial development. This engineer is Charles S. Cook, vice-president of the Duquesne Light Company, who figures in units of 60,000 kw. and more with far less concern than he did with his two 150-kw. generators and their forty-eight glass-jar transformers in the California canyon thirty years ago.

Mr. Cook was born on a farm at Amherst, Mass., the son of Horace W. and Mary N. Cook. He was educated at Worcester Polytechnic Institute and was graduated from this school in mechanical engineering in 1885 with the degree of bachelor of science. He went to Pittsburgh in 1887 and began work in the shop and testing room of the old Westinghouse Electric Company's plant in Garrison Alley. The following year he became installing engineer in charge of the erection of lighting and power plants, and in 1889 he became engineering superintendent of construction in the Chicago offices. In 1892 he laid out the first long-distance transmission system installed in the United States, making it 10,000 volts, when all of his engineering associates thought half that voltage was the commercial limit.

In 1893 Mr. Cook laid out for George Westinghouse the electric plant for the Columbia Exposition at Chicago. In 1895 he returned to Pittsburgh, taking charge for the Westinghouse Electric & Manufacturing Company of special sales engineering work in the Pittsburgh district. At that time the great steel mills were practically without electrical equipment, motors being confined to cranes. Duquesne had no electric power, Homestead had only 300 hp. and Edgar Thomson 100 hp. Now electricity practically dominates the operation of these monster mills. In January, 1899, Mr. Cook became manager of the Westinghouse Pittsburgh office, taking charge in April, 1904, at East Pittsburgh of that company's railway and lighting department and controlling all commercial operations relating to power machinery.

On March 1, 1917, he became general manager of the Duquesne Light Company, and on Dec. 1, 1922, was made vice-president. He is now at work upon many plans for the further expansion of the Pittsburgh district as a great electrical center.

Editorial Comment

Electrical World, September 8, 1923

Volume 82 Number 10

Blend of National Characteristics Will Help Research

THE Anglo-Saxon race as a whole has been prone to empiricism, while the Teutonic scientists have been decidedly inclined to *a priori* reasoning. Both races have prospered and suffered from this one-sidedness and a union of these opposite racial characteristics should lead to wonderful results. A new tendency—namely, a combination of these national characteristics—is shown in the thermal or "pyro-electric" theory of breakdown which was almost simultaneously presented by the prominent German physicist and engineer Dr. Karl Willy Wagner and by Dr. C. P. Steinmetz and J. L. R. Hayden of this country. The conditions and principles which led up to and influenced this investigation are applicable to many branches of physics or engineering. They may be thus stated: (a) An investigator finds some facts contradicting an accepted theory; (b) he establishes a new theory based upon rational physical foundations; (c) he and his co-workers verify the theoretical conclusions by a series of tests.

In the past, unfortunately, the procedure when engineering difficulties have arisen has frequently been as follows: (a) Certain facts are found not to be in accord with preconceived views; (b) tests are made which do not clear up the matter; (c) more tests are made; (d) still more tests are made; (e) a large committee of busy men is appointed, to serve without compensation; (f) the committee issues a long preliminary report on what ought to be done; (g) matters of more immediate importance permanently distract attention from the problem. It is to be hoped that the old procedure is fast on the ebb and that it will eventually give place to a combination of all the good qualities in research methods everywhere.

Crest Measurements Require Care

THE accurate measurement of the crest value of high alternating voltage is a matter of considerable complication, if not difficulty. With sufficient care, in a well-equipped laboratory, a high degree of precision is possible, as, for example, by the rectification of the charging current of an air condenser and its measurement with direct-current precision instruments. Next in order in decreasing complication, but also diminishing accuracy, are the corona voltmeter, apparently a very accurate instrument in its complete form; the sphere gap, and finally the ratio of transformation and the low-voltage instrument. The size and auxiliary equipment of the corona voltmeter has so far discouraged its general use, particularly in comparison with the much simpler sphere gap, although both are accepted A. I. E. E. standards. In careful hands the sphere gap will give a crest reading accurate to within 1 or 2 per cent.

But even the moderate complexity of the sphere-gap measurement, or perhaps the need of the careful hands, too often leads to reliance for an estimate of the crest voltage on the combination of a low-voltage measurement, a ratio of transformation and a guess at the crest factor of the alternating wave. The possibility of making the reading entirely in the low-voltage circuit and on the scale of a portable instrument is very tempting as compared with the time and care required by other methods. Ratio of transformation is relied on in many forms of station transformers, but in these the load is usually fixed and its influence on the voltage wave form small or at least known. In high-voltage testing, however, as is well known, the voltage wave may be badly distorted by the capacity of even ordinary equipment and connections on the high-tension side, particularly if the generator wave itself has any appreciable irregularity. It is an old story, but a more or less innocent-looking primary voltage wave in conjunction with the capacity of the high-voltage secondary connection sometimes leads to some very remarkable values of crest factor, which cannot be predicted even with complete knowledge as to the generator wave.

Begin Public Relations Work with Company Employees

GOOD public relations are held by some to be the greatest asset a utility has. They are admitted by all to be of real value. The topic has, however, been treated so copiously and so frequently that it threatens to become trite. The condition is somewhat analogous to that of the man who attends church each Sunday, admires and agrees with the sermon and then forgets his religion for the other days of the week because of the pressure of everyday work. It is continuous practice that really causes results.

The more one studies the question, the more apparent it is that many really efficacious ways of bettering public relations are being neglected by some utility executives who complacently regard the subject from the perspective of their positions and the flattering remarks of understanding friends in their community. The man who is successful in his public relations work is constantly in touch with its effect. And most important, while he uses newspaper advertising, illustrated booklets and motion pictures showing the company's facilities, and while he conducts customer-ownership campaigns, he does not believe that these are the only essential things or that the amount of money spent in this way is a direct measure of the progress attained.

One point cannot be emphasized too much or too often. Public relations must be studied and improved at the

source if real and permanent progress is desired. It is the employee of the company in his every-day work who most effectively makes or mars public sentiment. And yet how many general managers, filled with ideas on public relations, know even the name or personal appearance of the "girl at the window," the meter reader, the troubleman, the power salesman or the many others down the line who form the myriad points of contact with the public?

Direct thought must be given to all these individuals to help them develop good public relations through the way they conduct themselves in their everyday work. Specific ideas in words that interest and appeal to these employees, financial inducements and many other agencies may be utilized. A local and personal flavor must be given to the public relations activities, and every man in the utility must be an active worker before any executive can say that he has done everything possible to improve the standing of his company with its customers. Any executive can well devote as much time to knowing his employees and "selling" them his ideas on public relations as he devotes to chamber of commerce meetings and other public affairs, and with far greater return in the way of improved public relations. He can eliminate the little customer ills before they occur and prevent their developing complications that require major operations. In other words, company spirit and company courtesy are the proper and only sure weapons to develop the right kind of public relations.

Corona and Spark-Over Between Electrodes of Various Shapes

ONE of the signs of progress in high-voltage engineering is a slow but steady advance of the theory whereby dielectric stresses can be predicted from the design rather than measured on a device already built. The mathematical theory of electrostatic field distribution between two given electrodes is quite involved, and exact solutions have been obtained only in a few of the simplest cases. The problem is further complicated by the phenomenon of ionization of gas molecules by collisions with free ions near the surfaces of the electrodes. Because of this ionization a rather involved relationship exists between the curvature of the electrode, the thickness of the ionized layer of gas and the magnitude of the corona-forming voltage gradient at the surface of the electrode.

One of the cases amenable to mathematical treatment is that of the electrostatic field between two parallel cylinders of infinite length external to each other. This arrangement has been considered theoretically by F. W. Peek, Jr., Dr. Alexander Russell and Dr. A. E. Kennelly. With a small spacing between the cylinders a spark-over occurs almost simultaneously with the first corona, while with a larger spacing a stable corona is possible. The names "spark-over system" and "glow system" suggest themselves for these two ranges. By the introduction of an auxiliary hyperbolic angle Dr. Kennelly simplified the theory and the final formulas. It is possible that a still different aspect of the problem can be had by using an auxiliary circular angle.

In time a similar mathematical treatment should be extended to electrodes of other shapes, so that a designer of high-tension insulation may use rational formulas and a slide rule like his more fortunate confrères who figure out machinery and feeders. The mathematical theory of high-tension stresses is one of the phases of the problem of dielectrics, and the committee on insulation of the National Research Council should not lose sight of the necessity of promoting its advance side by side with the experimental study of materials.

Growth of High-Voltage Networks Introduces Control Problems

THE problem of regulation and control on single long-distance high-voltage lines has been solved to a very satisfactory degree by the use of the synchronous condenser and by specially designing the generators to care for no-load charging conditions. But there are several problems connected with interconnected high-voltage networks that are difficult of solution, and so far no generalized treatment has been developed. These problems are the more pertinent because several systems are now under construction that expect to encounter them as practical operating difficulties. Take, for example, a system with three steam generating stations 100 miles apart and connected by a 165,000-volt line. In addition, assume that a hydro-electric station 100 miles away is tapped to the line at the center and near one of the steam stations. These 165,000-volt lines supply a dozen or more large substations at various points. The question then arises: How can the voltage regulation at each substation and at the "T" point on the transmission system be controlled? Also: How can the load division between generating stations be controlled? In addition: What are the limits of stable operation of the system if certain short circuits occur?

Such questions are fundamental and require an answer if satisfactory commercial operation is to be had. But, with the present state of the art, it is not surprising that there are very few men, even among the specialists, who will venture to give to them even the basis of an answer without a very laborious and detailed study of all the operating conditions, combined with difficult mathematical analyses and computations involving the constants of the system.

And yet such a network as the one described is in itself far from being as complicated as many that are now in process of development. It is to be expected that the engineers in charge of these developments have worked out the answers for their respective systems, but none of them have indicated that they have been able to accomplish any great degree of simplification. At best solutions to such problems, based on present knowledge and practice, involve the use of a great deal of equipment and a very detailed set of instructions for the operating organization. The use of synchronous condensers, variable tap transformers, induction regulators, special devices in the generating stations and complicated relay schemes are necessary in the light of present knowledge and available equipment. But it must be admitted that these devices, while splendidly serving in certain fields, as a whole form an unsatisfactory solution to the problem encountered on the new type of system where an immense amount of energy is to be handled and reliability of service is paramount.

Complex solutions of extensive problems usually become less involved as experience and time indicate possibilities of simplification. But the situation in trans-

mission networks is such that there is real need for an approach from some angle so far not considered. Some genius has an opportunity to obtain a better solution to the general problems encountered on such systems.

Transatlantic Radio Telephony

IN THE early flush of enthusiasm over the discovery of wireless telegraphy, among the most important advantages claimed were the possibility of selective sending and receiving offered by frequency adjustment and the wide range of wave lengths permitting numerous simultaneous messages. In the many long steps ahead since those early days, wave-length adjustment as between sender and receiver has continued an important feature of all radio transmission, but most serious limitations have developed as to the range of available wave lengths and the number of individual wave lengths which may be used within that range without mutual interference. Among other reasons for this limitation is the impossibility of restricting the energy of both sender and receiver to a single wave length. Resonance curves always have some width and they spread out at the bottom. This means spilling over into other wave lengths in sending and picking up something undesirable in receiving. Every amateur knows how wide a range of tuning is necessary to eliminate an undesirable incoming message completely. Thus not one wave length but a whole band must be devoted to a particular sender or group of senders, and consequently the whole spectrum of radio wave length is divided by law into a limited number of bands assigned to different classes of service.

The situation is even worse in the case of radio telephony, in which a sustained "carrier" or sending frequency is "modulated" in intensity to conform to the voice tones. This means that all the frequencies in the voice are superimposed on the carrier frequency, and thus that the minimum width of the frequency band necessary for carrier-wave radio telephony is more than 6,000 cycles, embracing the two 3,000-cycle side bands, one on each side of the carrier frequency. The most striking case is that of transoceanic service, in which, on account of daylight attenuation, the frequency must be below 60,000 cycles, and, to avoid telegraphic interference, above 30,000 cycles. Thus in the ordinary carrier system only four transatlantic channels of operation are open with equal limitation on the number of messages. And this is not a question of closeness of resonance, but is a matter inherent in the system itself.

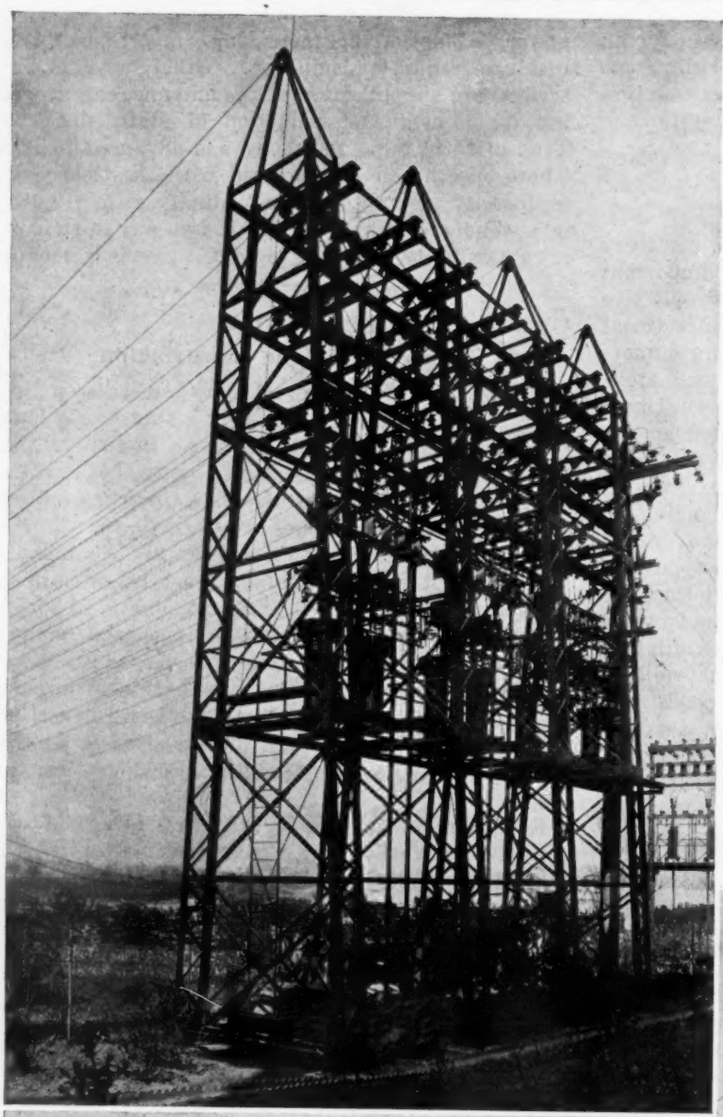
Recent experimental development in this field, as described in a paper by Arnold and Espenschied before the Swampscott convention of the American Institute of Electrical Engineers, has resulted in a substantial improvement of this limitation by the perfection of the so-called single-side-band eliminated carrier system. In this system a bridge or balanced type of modulator completely suppresses the carrier frequency in the complex modulated wave, leaving only the side-band resultants. One of these is suppressed by a band filter and only one side-band resultant is amplified and transmitted. At the receiving end the carrier frequency is put in again, permitting telephonic detection in the usual way. The elimination of one side band virtually doubles the number of available transmission channels, and the suppression of the carrier frequency conserves transmitted power, a matter of increasing importance in long-distance radio transmission. Other advantages described are simplification of the antenna, ease in receiving adjustment and reduction of static disturbance. Transatlantic radio telephony has advanced to a point where speech can be delivered with the clearness and uniformity met with in the ordinary wire circuit. It is a wonderful achievement. If two-way speech is not yet a possibility, it is safe to predict that it is not far off.

Quantity Production Methods in Transmission-Line Construction

THE construction of a heavy steel-tower double-circuit transmission line with a length of a hundred miles or more is a job that compares in size with many types of structural construction jobs that have been considered big. The cost of such a line runs well above a million dollars, and, unlike the majority of jobs of this size, its construction problems are scattered over miles of territory in place of being concentrated in a few acres at most. There is thus more than ever opportunity to waste money unless the men in charge know how to lay out the work and keep the men working to the best advantage. The idea that factory production methods offer anything of use in this connection is scarcely entertained, and an investigation to determine if such methods are applicable has seldom been undertaken.

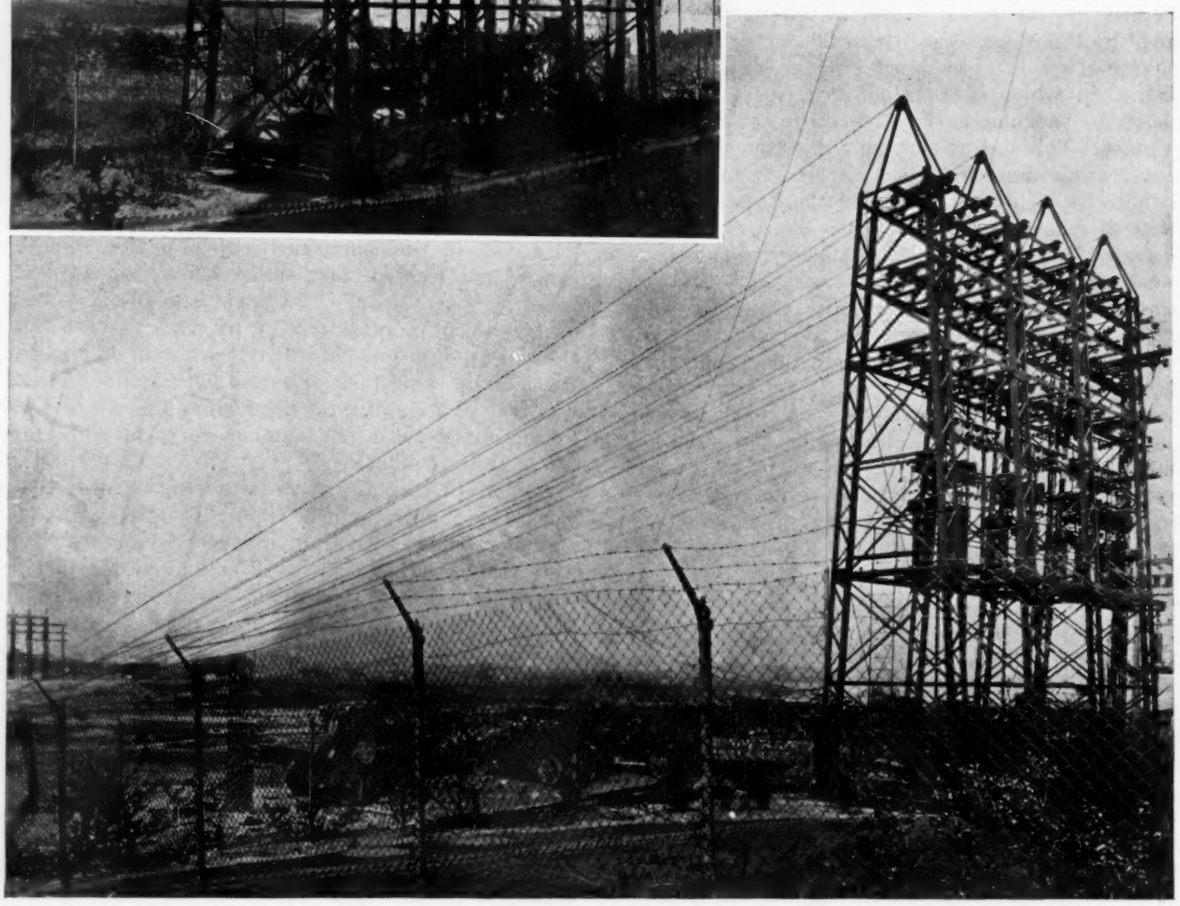
Elsewhere in this issue is a description of a line built by the Kansas Gas & Electric Company in which a definite application of quantity-production methods was made in the handling of the entire job. The building of the towers, which is the most difficult individual item in such work, was split into a number of operations —footings and stubs; assembly of towers, by two different gangs each handling a part of the tower; erection, also by two different gangs handling different parts of the tower, and placing the insulators. The material gangs distributed the parts so that each was always to be found in the same position, no matter where the tower was located, and the assembly gangs left the assembly parts always in the same position, so that as each succeeding gang took up its work it went through the same motions as before and each man on a gang performed the same task over and over again. The same was true of stringing the conductors, and an interesting fact was the use of dynamometers in place of targets for sagging conductors.

To help in keeping the work moving steadily the men were thoroughly drilled in their duties, and every method used was carefully worked out before the men were instructed, so that every man knew his duties and what was expected of him and few embarrassing shifts had to be made. The use of auto-trucks contributed materially to the machine-like precision with which operations moved. The description of the construction methods contains many valuable suggestions for those who handle such work, and not the least valuable is the method of handling the labor through permanent camps at advantageous points. Labor is always a problem because of the large turnover that is ordinarily a feature of camp jobs of any kind. The method followed on this job reduced the labor turnover to a fraction of what it usually is, because comfort for the men off duty was the primary object sought in camp arrangements.



Crossing the Miami River with Six 6,600-Volt Circuits

TO ACCOMMODATE the six circuits from the Millers Ford plant of the Dayton Power & Light Company crossing at 6,600 volts the Great Miami River into Dayton, two 18-ton towers were erected. Using a span length of 900 ft., the line was sagged to 14 ft. at a temperature of 40 deg. F. The main tower in the foreground is close to the plant and has an elevation of 50 ft. up to the top conductors, while the opposite tower stands 5 ft. higher. Conductors of No. 4/0 seven-stranded bare copper wire are dead-ended on a row of five pin-type insulators which are jig-cemented to caps and pins. These pins are bolted to the channel bases and half-inch boiler plate is fastened to the caps of the insulators, distributing the conductor stress transversely upon the five insulators. The circuits leave the station through 350,000-circ.mil cables rising in the tower legs and passing through choke coils to the river crossing conductors. There was installed on the platforms a three-phase electrolytic arrester for each circuit with the necessary reversing and disconnecting switches. The towers were designed for a maximum stress of 135,000 lb. with an assumed factor of safety of three, while the foundations have a safety factor of two.



Heavy Transmission-Line Construction

Kansas Company Establishes Permanent Camps to Lodge the Men Who Build Its Steel-Tower Lines—Factory Quantity-Production Methods Applied in Tower Erection

WHEN a heavy transmission line is under construction the question of how the workmen shall be cared for is a serious one. In some of the older and more settled parts of the country it is possible to gather a construction crew who will find their own board and lodging, thus removing that worry from the mind of the construction superintendent. When lines are built across country in the mountain and Far Western regions such arrangements are not possible. Similar lines are multiplying in the Middle West and East, and for the men to find their own board and lodging within reasonable distance of their work becomes more difficult, particularly where the lines are erected across agricultural territory and towns of any size are few and far between. The establishment of labor camps, therefore, often becomes necessary. Generally, in transmission-line work these camps have been of the movable variety, and the transmission-line worker knows the unpleasantness of moving day in such camps, when eating and sleeping seem for a day or two almost like lost arts. The camps present a problem also from a sanitary point of view because all arrangements of any kind are extremely temporary. Resentment against living conditions has been a big reason for the large labor turnover for which camp jobs of every kind have been noted.

When it became necessary to establish camps to handle the labor on the Midian-Neosha 132-kv. line of the Kansas Gas & Electric Company it was decided that, in place of a few movable camps, a somewhat larger number of permanent camps would be used. These camps were ten in number and all alike in arrangements, so that when it became necessary for a gang to change its sleeping place it merely meant going to the new camp at the end of the day in place of back to the old one. A man could immediately make himself comfortable and the dining room was ready for him at the accustomed hour. The buildings in this case were merely tents with wood floors or other protection against the weather, which is rather mild in this part of Kansas during the winter. Each camp was supplied with its dining room and a cook and his helpers. A commissary building was also provided in which a small stock of tobacco and the little knickknacks that are necessary were carried. Socks, gloves, and other like items of clothing were provided in small quantities so that men would not find it necessary to be continually running to town. In the same building space was provided where the men could gather during the evenings to read or amuse themselves in legitimate ways. Reading matter, including current magazines and daily papers, was provided. The camps were put under the supervision of a physician, and a regular inspection and report of camp conditions was made. Every effort to see that the men were comfortable and that the surroundings were healthful was put forth. As the work was carried out with gangs each organized to do certain portions of it, the number of men in any camp at one time was not large, and as each section of the line was completed and cleaned up the camps on that section were abandoned.

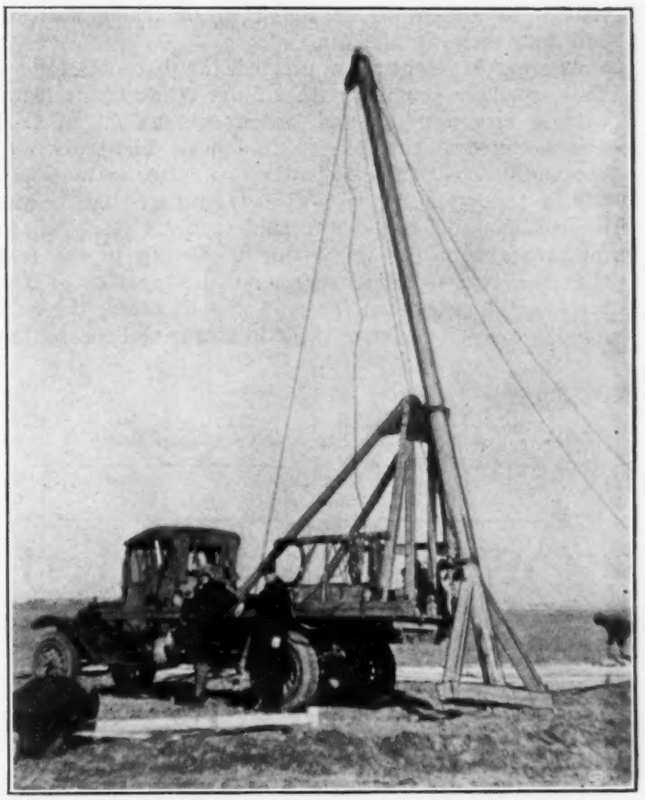


FIG. 1—TRUCK AND GIN POLE USED IN ERECTING TOWERS ON MIDIAN-NEOSHA TRANSMISSION LINE OF THE KANSAS GAS & ELECTRIC COMPANY

TOWER ASSEMBLY AND ERECTION

The usual method of tower erection has been the assembly of the towers on the ground and raising them by means of a gin pole which itself must be raised and guyed at each tower location. After a study of the situation it was decided to try a new method of handling the work, based on the factory theory of quantity production. The excavation and setting of stubs by templates was carried out in the usual way.

The tower assembly work was divided between two gangs, one of six men and the other of eight. The gang of eight men assembled the entire batter sections for the two sides of the tower, placing the connecting bracing which forms the other two sides on the assembled sides so that when the batter sections were raised all the material needed to complete this part of the tower would be in the air and ready to bolt to the opposite member. The other gang of six men assembled the top or mast section and the spiderweb bracing at

the bottom of the tower. All of this work was done from material that had been distributed and laid in certain specified positions on the ground so that there would be no searching for material and unnecessary running around. The assembled parts were also left in certain definite positions ready for raising and each man on an assembly crew had his exact work to do. All this work was so planned that no one stood around idle, and when assembly was complete all that was necessary for the erecting crews to do was to pick up the parts that were always to be found in the same position and put them in the air.

A crew of eight men erected the batter sections. This crew was supplied with a 2-ton White truck, fitted with a large engine and winch equipment. A pole was mounted on the rear of the truck. The truck was backed into position between the two batter sections laid out by the assembly crew, already-prepared tackle was hooked on, and the two batter sections were raised into place with the truck winch. Owing to the fact that the two sections were on opposite sides of the truck and the load on the pole was balanced, the only guy lines necessary were those to steady and control the

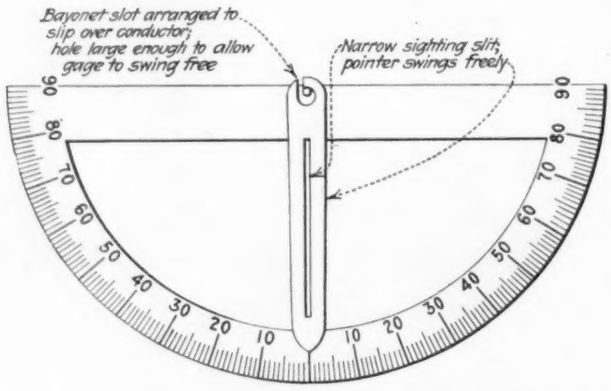


FIG. 2—WIND GAGE WAS USED TO OBTAIN CORRECTIONS FOR THE EFFECTS OF WIND VELOCITY ON TENSION IN STRINGING CONDUCTORS

This was used to find the swing of the conductor under wind pressure, and a table with the proper tensions for the various degrees of swing was referred to for the stringing tensions.

parts as they were raised into position. These consisted of a rope-back guy on each of the sections and a tie between the two sections.

Once the batter sections were in the air, one man started at the ground on each tower leg and rapidly bolted the bracing for the other two sides into place. Two men on the ground took care of the needs of the tower men, and the rest of the crew put all tools, ropes and other materials back on the truck ready to move to the next tower location. In this operation, as in the assembly, every man has his particular job to do, and the tools and equipment on the truck were always put in the same place so that there was no confusion in finding the things needed. A representative of the ELECTRICAL WORLD watched the erection of the batter-section of a tower by this method in which the elapsed time from the arrival of the truck at the location and its start to the next location was thirty minutes. Almost the only spoken words were those of direction to the truck driver as he backed his truck to position for tower erection and the requests of the men on the towers to the ground men to "take up" or "ease off" a guy. The truck was equipped with pneumatic tires and seemed able to traverse almost any kind of ground, even newly-plowed fields. In spite of the cross-country work during the winter none of the trucks had stuck. Although this country is flat, it is apparent that such trucks are capable of work over fairly rough territory.

The masts were put in position by "topping" gangs of six men each. These gangs, of which there were six, also erected the insulators. It was found that the complete assembly of the tower, including the mast and raising into position with the batter section, required too much rigging to prevent bending of the members and that separate erection was the cheapest. Here as in the rest of the tower work each man had his place and work to do. The average number of towers erected in a day by this method was about ten.

STRINGING AND SAGGING OF CONDUCTORS

All sagging of conductors was controlled with the dynamometer. The instrument used on this job had a maximum reading of 5,000 lb. A standard test instrument was kept in camp for test purposes and the instrument in use was checked daily before being allowed on the job. The instruments in use are carried in specially constructed cases to preserve them from injury. In addition to the use of the dynamometer, check sights on at least one span of normal length in each pull were taken by means of targets set up on the towers for the purpose. In this way the stringing crew made certain that sagging was correctly done.

Owing to manufacturing conditions for this size of conductor the lengths were short, half-mile reels having to be handled. The conductors were spliced in the manner recommended and approved by the manufacturer. One of the problems in handling aluminum conductor is to avoid damaging it and leaving weak spots that may cause future trouble. Dragging it across the ground, as is the usual method in stringing, does not help the situation. On this construction job two 2-ton White trucks were fitted up to carry three reels of conductor each. The conductor was "paid out" as the trucks traveled along one on each side of the line of towers. Where unpaved highways were crossed the conductors were buried in a trench across the road until they could be pulled to position.

At each tower the six conductors were hoisted by light tackle and placed in snatch blocks. These snatch blocks have a heavy wood frame with lignum-vitæ sheaves 12 in. in diameter and have been found to be the best for stringing any type of heavy transmission conductor because they do not chafe the conductors in case of a jam as metal blocks will. The large sheaves allow the conductor to adjust itself easily during and after pulling. In order to keep them in condition, they are dipped frequently in oil. On this job the old crankcase oil from the motor equipment on the job was utilized.

Motor trucks like the one used in tower erection were each equipped with a winch. When conditions were ready for pulling the conductors, "come-alongs" were attached to each end of a flexible steel rope carrying a snatch block at its center which served as an equalizer, when attached through tackle to the truck winch drum. Between the steel rope and one "come-along" was connected a dynamometer. With this arrangement two conductors could be sagged at once. The truck winches had ample power to develop the tension necessary, and as they are operated through worm gears the control was excellent. The construction crews

declared they could control the conductor tension within 5 lb. The foreman in charge was supplied with a table of tensions to be used under various temperature conditions and a small and accurate pocket thermometer of the clinical type to read temperatures.

Wind caused considerable trouble in the pulling of the conductors. With wind velocities of greater than 30 miles an hour conductors could not be pulled, and

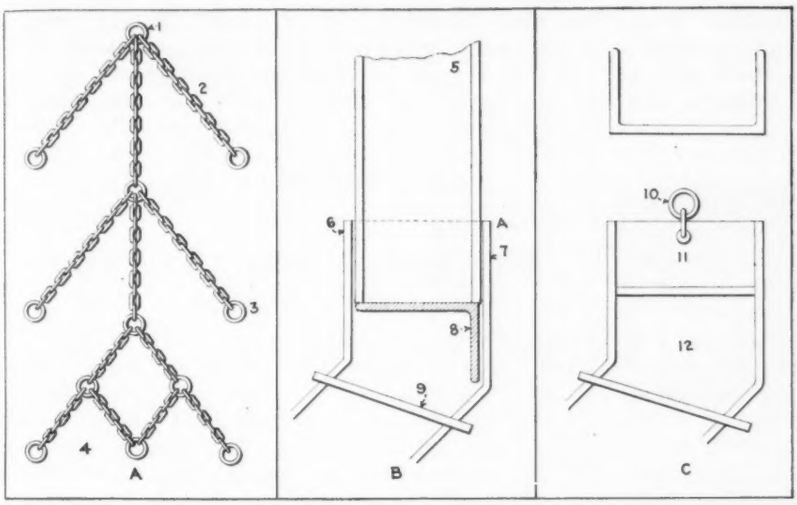


FIG. 3—SOME CONSTRUCTION KINKS USED

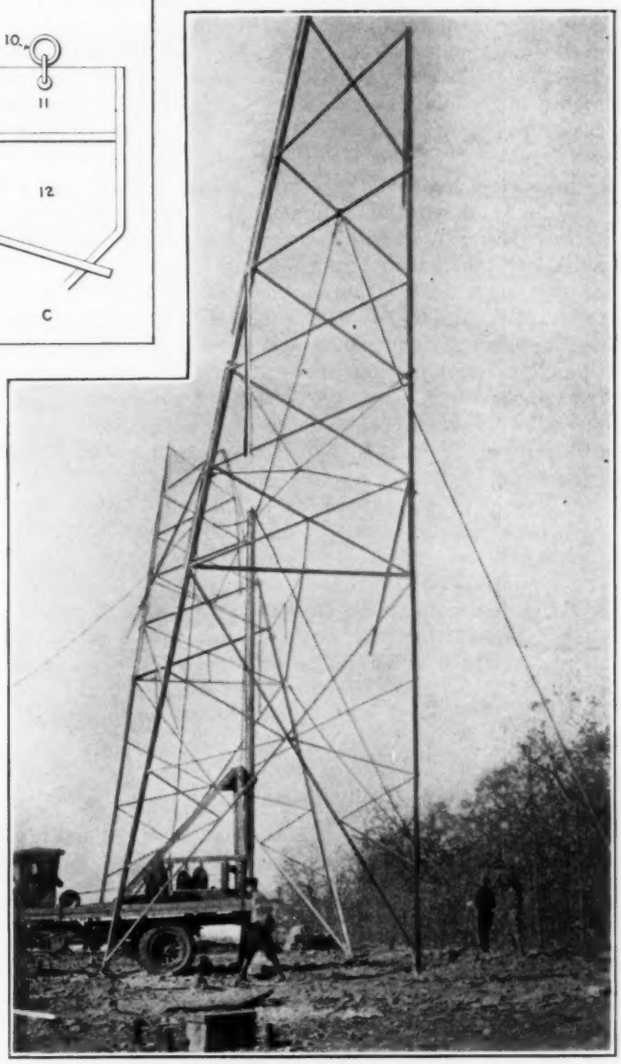
A is a chain anchorage used for snubbing tackle, and B shows the shoe used in the erection of the batter sections of the tower to prevent the tower legs slipping past the stubs.

(1) Chain to tackle; (2) unit of three 18-in. chains with big link at junction and similar links at end of each chain (big links large enough to take 1-in. pin used as stake); (3) four parallel pins 1 in. x 36 in. hexagonal steel with upset heads; (4) two chains made up with big connecting link; (5) tower angle leg as it lies on ground ready for erection; (6) shoe in use; (7) erection shoe; (8) tower stub; (9) rod to hold shoe in place around stub; (10) link for anchor stake if needed; (11) bottom for tower leg to rest on; (12) open space to fit over stub.

under that velocity it was felt that there should be some correction for the wind pressures. Accordingly a wind gage was devised. This consists merely of a large protractor with a loose-hung pointer having a long narrow slit along its center line. The device is hung on the conductor at the tower and by sighting through the pointer slit at the conductor in the center of the span the deflection due to the wind could be read. With this deflection and a table of corrections the foreman could select the proper tension to which the conductor should be pulled. The table of corrections merely showed the correct tension for the temperature prevailing when the conductor swing was any given number of degrees.

Between the time of sagging conductors and the tying in to the clamps several days was allowed to elapse so that the conductor would adjust itself. During the whole operation rope tackle was used only for snubbing the conductors when a new hold had to be taken to pull in more slack. This is an important point, since rope tackle, in spite of its extensive use, introduces an element of uncertainty that sometimes makes for serious accidents. The breakage of a rope at a critical point in the pulling of large conductors is generally attended with unpleasant consequences. In anchoring the snubbing tackle an interesting device was used. It consists merely of an arrangement of chains with links large enough to take a 1-in. hexagon rod welded in at intervals. These rods or pins are made of tool steel, are 36 in. long and have upset heads to prevent battering when they are driven into the earth. They make a temporary anchorage that can be rapidly placed in position since all that it is necessary to do is to lay the chains in position and drive the pins. There is sufficient "give" in the arrangement to equalize the strain between the pins in the group.

In tying in the conductor it is necessary to use a protective sleeve to prevent its being damaged by the clamp. On the Kansas job about 15 ft. of aluminum ribbon, 0.3 in. wide and 0.05 in. in thickness, was spiraled around the conductor. As the ribbon came in large reels, it would have been awkward to cut off and handle merely the lengths required each time, so small reels were



RAISING A BATTER SECTION USING SHOES AND STUBS EQUIPMENT DESCRIBED IN FIG. 3

made which would hold just the proper length of ribbon. Then in camp small compact spirals were formed which would fit into the pocket and which could be carried up the tower without inconvenience.

In the erection of the towers two of the batter-section legs butted against the stubs on each side. To offset the stress and prevent bending of the stubs, 4-in. x 4-in. timbers cut to the right length were put between the stubs as braces. As the batter sections were raised on opposite sides the bracing took the stress

from both directions. The shoe shown in the accompanying illustration was used to hold the tower legs in line with the stubs as the sections were raised and also to hold the legs at the proper height to allow bolting to the stubs.

The test checks on the dynamometers were made on a rectangular frame of 4-in. x 4-in. timbers, with a cable anchorage on one of the short ends of the rectangle and a heavy rod with a machine bolt thread on the other. This was passed through a threaded metal plate. With the standard-test dynamometer and the working instrument swung between these centers and a crank with a threaded end to fit over the threaded rod the two instruments could be pulled to tension.

In place of the boatswain's chair frequently used for adjusting insulators and tying in conductors, small ladders similar to a fireman's scaling ladder were used. These merely hooked over the cross-arm so that the man could work from them at the level of the conductor fastening. Moreover, they could be placed out on a dead-end so that the fastenings could be reached.

As stated already, the effort in organizing the work was to build up the gangs so that each man had a definite thing to do and the work was evenly distributed among the men who composed any one gang. In a job of this size there is sufficient work of different kinds to permit this to be done successfully, and the work can proceed without the "whoop and holler" method that is a familiar part of so much line work. On the trucks carrying tools every item of equipment had a place, and it was the business of the men who had to use equipment to see that each item went back into its place.

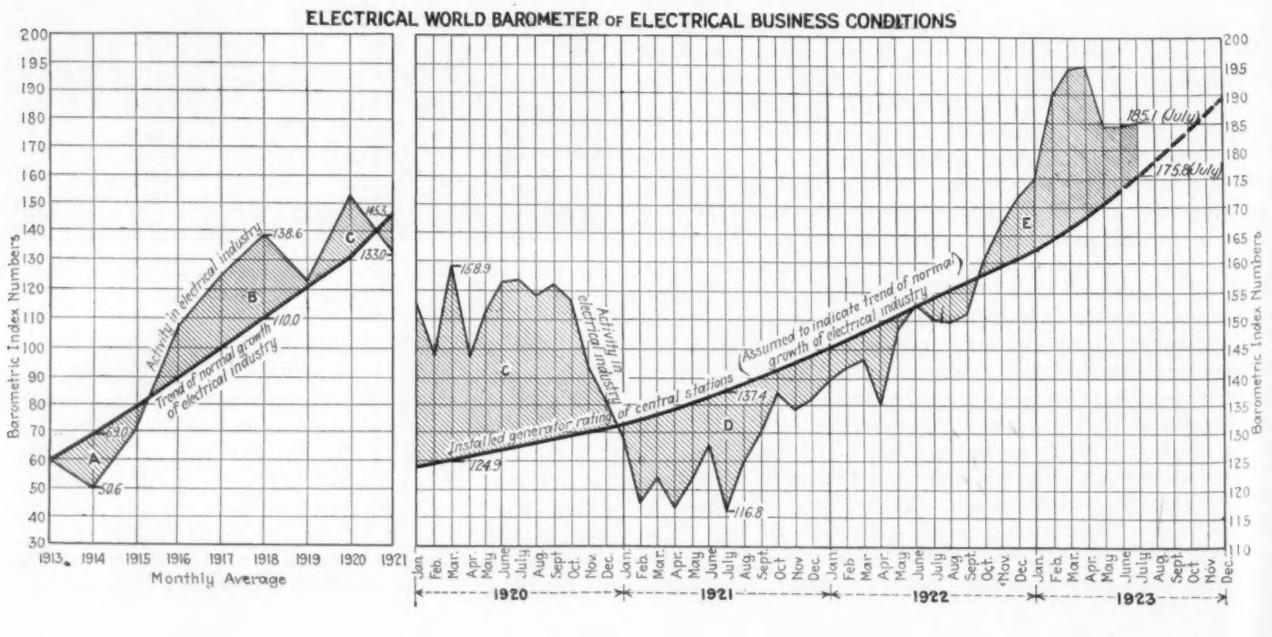
When a crew started on a piece of work, such as tower erection, every man knew his place and the things he had to do. The assembly crews found the tower parts in the same place on every location and left the assembled parts in exactly the same position in each case, so that the erection gangs had no adjustments to make when they arrived at the location but could go ahead with the scheduled routine. The effort throughout the job was to carry out every operation on this principle.

An interesting phase of the records was the progress chart. Listed vertically on the chart, on the wall of the construction office at Fredonia, were the items of right-of-way secured, holes dug, stubs distributed, stubs set, tower steel distributed, towers assembled, towers erected, insulators hung, wire distributed, wire strung, wire sagged, wire tied in and clean-up. Opposite each item was a space to represent each tower on the line. As each item of work was complete the space for that tower was filled in in red crayon. At the end of each week the red was covered with black crayon. The chart therefore showed graphically the progress of the work, the work immediately completed being indicated in red and that completed in the previous weeks showing as black. Space was also provided under each tower in which to show the date on which the final clean-up took place and the work so far as that structure was concerned was finished.

Midsummer Activity 9.3 per Cent Above Normal

INDEX figures upon which the "Electrical World Barometer of Business Conditions in the Electrical Industry" is based indicate that activity in a large proportion of the primary industries of the country was further curtailed during July. The iron and steel and the copper industries are notable exceptions to this general trend. Statistics of former years indicate that such a slowing up in the activity of the mills and factories of the nation is normal during the midsummer season and yet the industry as a whole is operating several points above the value that would be indicated by normal estimated growth.

The data upon which the "Electrical World Barometer" is based indicate an increase of seven-tenths of a point on the barometer scale as compared with June activity. During this interval the industry has grown 2.5 points, leaving a net decrease in activity of 2.2 points on the barometer scale as compared with June. The electrical industry as a whole was operating in July at 9.3 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In June it was operating at 11.5 and in May at 13.6 points or per cent above the point of normal demand.



Electric Furnace Demonstrates Flexibility in Steel Foundry

Successful Results Obtained During Good and Bad Operating Conditions — Location of Furnace, Selection of Auxiliaries, Acid Versus Basic Linings and Detailed Operating Results

By J. L. McK. YARDLEY
General Engineer Westinghouse Electric & Manufacturing Company

FEW installations have provided more opportunities for the electric arc furnace to prove its flexibility and adaptability under the changing commercial conditions that affect the operating requirements of a steel melting plant and foundry than has the 6-ton Ludlum-furnace installation at the Trafford foundry of the Westinghouse Electric & Manufacturing Company. This furnace, which was first placed in operation Feb. 27, 1920, was installed through the foresight of A. Slusser, foundry manager, who in addition to desiring to turn into ingots a large tonnage of nickel-steel scrap for rush-order costings which custom foundries were unable to deliver in time, anticipated considerable growth in the electric steel foundry business and wished his organization to become experienced in the making of electric steel under good and bad conditions and with a variety of materials.

At the outset it was realized that any single electric furnace installed in the Trafford works which was built, organized and operated as an iron foundry would be handicapped by local conditions more than would a steel foundry especially laid out for the purpose. It was concluded, however, that these conditions would not cause prohibitive operating costs, and might give better experience than would otherwise be obtainable.

Some of the conditions which existed are worth considering, both as an aid to interpreting the results obtained in this particular installation and as a guide to determining what conditions would produce the ideal situation in a specially designed electric steel foundry.

The furnace bottom as originally built had only 6 in. of magnesite over a 9-in. brick lining, and it had an actual capacity of more than 8 tons. Because of the necessary location of the furnace it is on the pouring-floor level, it is accessible to only one of the two cranes in the furnace bay, and the resulting necessary location of the furnace transformer causes unusually long secondary leads.

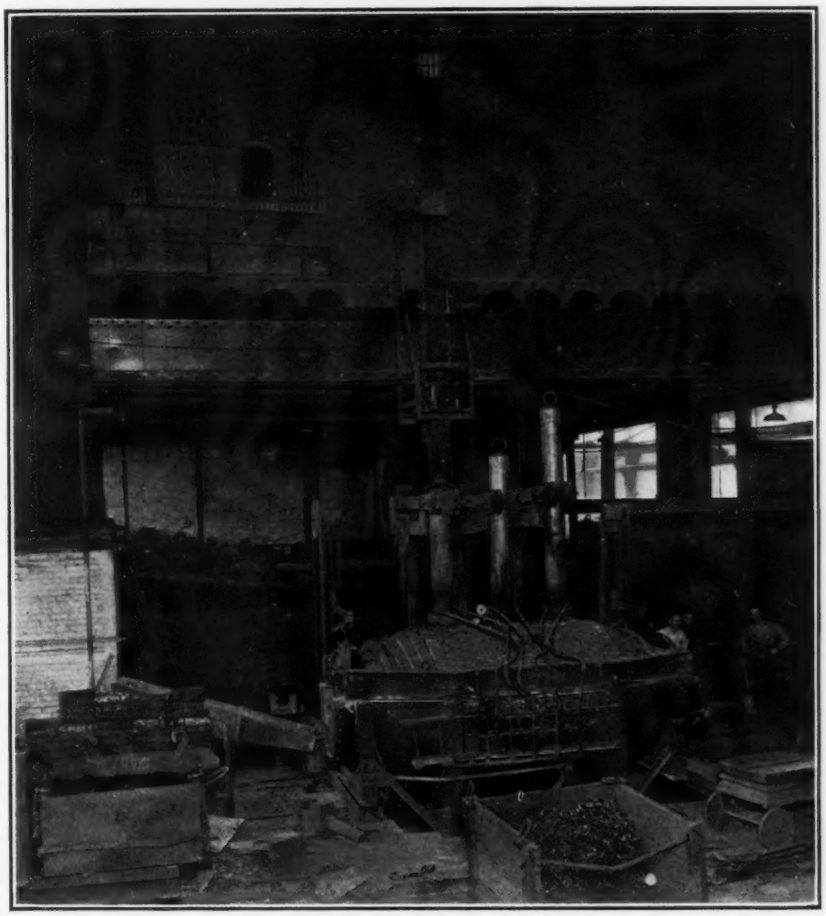


FIG. 1—6-TON LUDLUM ELECTRIC FURNACE AT TRAFFORD CITY STEEL FOUNDRY OF WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

In the foreground is a bucket containing steel turnings, and to the left is a carload of light charging scrap, including 3-in. shells. Also to the left is a spout for charging hot metal. Back of the furnace is shown the low-tension interlaced bus coming down from the transformer on the floor above. The furnace is equipped with three 10-in. graphite electrodes with a 27-in. separation. The bottom lining consists at present of 9 in. of silica sand over 9 in. of brick. The 30-ton reverberatory coal-fired air furnace to the rear and left is for the purpose of making large iron castings, and affected the location of the Ludlum furnace.

With small furnaces, from which the metal is shanked out directly in hand ladles, location of the furnaces on the pouring-floor level is unavoidable. But when the metal is handled by crane ladles there are many points in favor of setting the furnace on a raised platform of sufficient height to obviate the necessity for a deep ladle pit in front of the furnace and of sufficient area to make furnace operations as convenient as possible. This setting has a number of advantages:

1. It keeps the furnace crew away from the molders.

2. It permits mounting the tilting motors and machinery where there is less chance of injury by vagrant hot metal or water. (The Trafford furnace was shut down for several days at one time owing to the flooding of the pit.)

3. It cuts time in all operations of the ladle at the furnace and also makes for easier slag disposal.

As disadvantages this setting requires that:

1. A more expensive structure be provided. The whole building must be higher to allow the cranes to pass over the furnace.

2. All materials must be carried up to the platform. The space under the furnace is not wasted, however, as it can very conveniently be used for the storage of furnace materials.

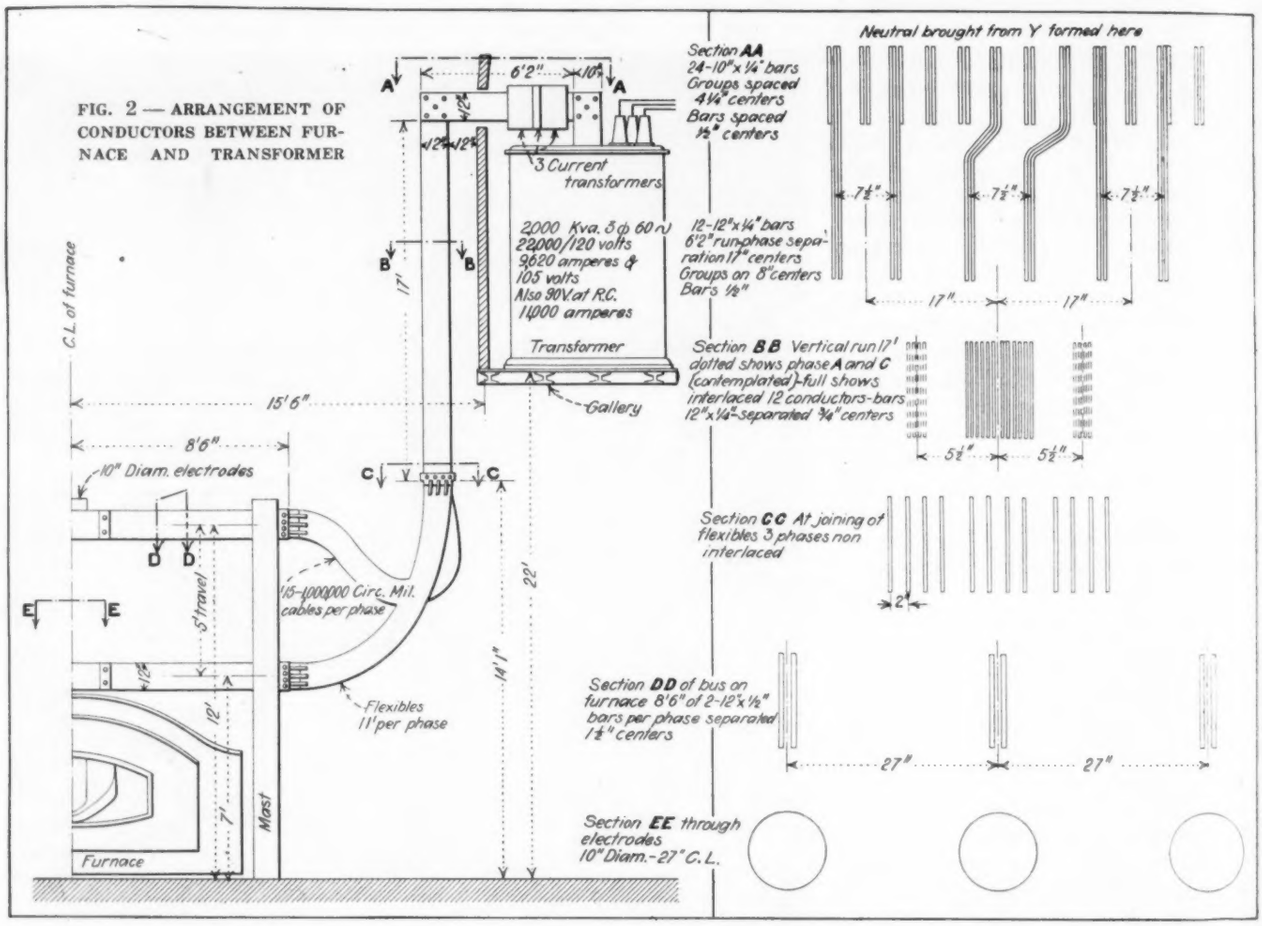


FIG. 2 — ARRANGEMENT OF CONDUCTORS BETWEEN FURNACE AND TRANSFORMER

Accessibility and adequacy of material-handling equipment are essential in order that operations shall not be hampered. Where the hot and cold metal are both handled by crane it is important for quick operation that more than one crane be available for work at the furnace at times of pouring and charging. This is particularly important where castings are poured directly from the crane ladle and where a crane is also required in charging the cold metal, either because of the size of scrap used or owing to the fact that top charging from preheated bucket is employed.

In one custom foundry, where the crane ladle filled with hot metal from the furnace is quickly deposited upon a car for transfer into the pouring-floor bay, where it is dumped by crane into a number of hand ladles, the furnace crane picks up the bucket containing the new charge of 5 tons of steel scrap, which has been preheating with oil, and takes it to the furnace, where it is lowered through the opened top and emptied. The whole operation of pouring and recharging the furnace consumes not more than fifteen minutes. Power is delivered to the furnace for from one hour and thirty-five minutes to two hours per heat. The maximum five-minute power demand is limited to 1,500 kw. Five heats are poured during the ten-hour operating day. The average power consumption is 460 kw.-hr. per ton of steel melted. From twenty to seventy heats are obtained per roof. Under the conditions existing at the Trafford works, where the furnace and pouring floor are fortunately in the same bay, really speedy operation at the time of pouring and recharging the furnace with the grades of scrap employed can be accomplished only by transferring the hot-metal ladle from the furnace crane to the pouring-floor crane and allowing the former to turn at once to the work of charging the heavy scrap. The present average time of one hour and fifteen minutes would, of course, be reduced materially if light scrap such as is easily shoveled by hand were used entirely, if a charging machine were provided, or if the frequency of patching the furnace bottom could be changed from once after every heat to every two or three heats or every day.

RELATIVE LOCATION OF ELECTRICAL EQUIPMENT AND FURNACE

Second only to the location of the furnace with respect to shop operations is the relative position of the electrical equipment and the furnace. At Trafford space was not available on the pouring-floor level for

the transformers and other equipment with the exception of the furnace-control panel, owing to the fact that power is supplied at 22,000 volts. For this reason it was necessary to place lightning arresters, incoming line circuit breaker and tap changing switch, metering panel, automatic regulator and the 2,000-kva., three-phase furnace transformer on a gallery 22 ft. above the pouring-floor level. This introduced problems in delivering power to the furnace which demanded special attention in the general consideration of a suitable layout.

MANUFACTURER'S REQUIREMENTS

The furnace manufacturer required that the furnace transformer be connected in star on the secondary side so that the neutral could be carried to the furnace shell. Voltages of 120 and 105 at full capacity and 90 at reduced capacity were specified. As indicated by Fig. 1, it was necessary, therefore, to make provision to carry a current reaching 11,000 amp. at full transformer rating a distance of approximately 43 ft. per phase from the transformer terminals to the furnace electrodes. The schedule* under which power is purchased required that this be done in such a manner that the high-tension power factor would be at least 90 per cent, otherwise a penalty would be incurred. It actually developed that fulfilling this requirement was less difficult than doing the job economically, that is, without appreciable efficiency loss due to futile use of an excessive amount of copper. It was appreciated that "mutual induction" and "self-induction" and "skin effect" combine to unbalance alternating current in parallel conductors and cause it to flow chiefly in the outer layers of the individual conductor, thus making it difficult at 50 and 60 cycles to design the heavy current-carrying buses and connectors. Thorough analysis† of these effects in the proposed electrical layout was therefore deemed essential before its structure could be finally determined and the material ordered. The structure selected, which is shown in Fig. 2, is designed to cause very small unbalancing effect and to operate at 96, 93 or 91 per cent power factor, at full rated transformer load, depending upon which voltage is being supplied to the furnace.

*In accordance with Schedule F (see *Forging and Heat Treating*, March, 1921, and *Blast Furnace and Steel Plant*, June, 1921), power was purchased from the Duquesne Light Company on a fifteen-minute demand basis.

†This analysis is given in detail, together with conclusions in the article on "Heavy Alternating-Current Busbars and Connections for Electrolytic Synchronous Converters, Electric Furnace and General Industrial Service," by J. L. McK. Yardley, *Blast Furnace and Steel Plant*, September, 1923.

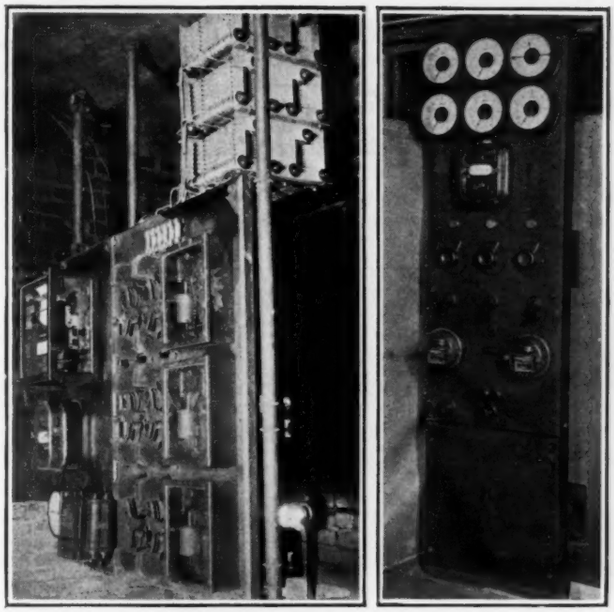


FIG. 3—AUTOMATIC REGULATORS, METERS AND FURNACE-CONTROL PANEL

The regulator panel supports the control element, the magnetically operated switches which control the electrode motors, the necessary switches and fuses with resistances and capacities mounted back of the panel. The control element consists of a pivoted lever floating in horizontal position with one core at each end extending into solenoids. The pull of one of these coils varies with the current which flows through the corresponding electrode, while the pull of the other coil varies with the voltage between the electrode and bath, or between two electrodes on a free-burning arc furnace. The pivoted arm has one set of contacts at each end. These contacts are so arranged that they control magnetic contactors, which in turn control the electrode motors. With power off the furnace this lever remains in horizontal position. On closing the main breaker, potential is immediately established between each electrode and the furnace charge. The voltage coil becomes energized and pulls its core up, thereby closing the contacts on this end of the lever, which in turn closes the contactors operating the electrode motor in direction to lower the electrode continuously and at full speed until it makes contact with the charge.

As the voltage coil is connected between the electrode and the furnace charge, its current will be shunted and it will become de-energized the minute the electrode makes contact with the charge, thus allowing the lever of the main control element to return to its horizontal position and open the motor circuit. As soon as the circuit has been completed by another electrode having made contact with the charge, the current coil becomes energized, thereby closing the contacts which cause the electrode motor to raise the electrode, thus drawing an arc to the bath. The motor continues to raise the electrode until the voltage between the electrode and the charge increases and its current decreases to such an extent that the pull of the voltage coil is equivalent to that of the current coil. The lever will then assume a horizontal position, opening the motor circuit. Any disturbance of the equilibrium between the pull of the coils due to variations in the arc will cause either contact to close, thus operating the electrode motor in a direction to compensate for the disturbance. A current-adjusting rheostat is connected across the current transformer. By changing its position, the value of the current per phase for a given current in the current coil of the element can be altered at will within the limits of the apparatus.

TABLE I—DATA ON STEEL CASTINGS PRODUCED ACCORDING TO FOUR DIFFERENT SPECIFICATIONS

Description of Product	A Soft Steel Castings	B Good Commercial Grade of Castings	C High-Grade Normalized Steel Castings	D Large Annealed Steel Castings
Manufacture	Castings to be thoroughly annealed	.....	Castings allowed to become cold and then uniformly reheated to proper temperature to refine the grain (approximately 1,700 deg. F.) and then drawn from furnace and allowed to cool in the air at ordinary shop temperature, protected, however, from moisture and drafts.	Castings left in mold until entirely cooled to 700 deg. C. Castings annealed by being heated slowly and uniformly to proper temperature to refine grain and held at this temperature sufficiently long to insure complete penetration and allowed to cool uniformly and slowly.
Chemical Properties by Analysis of Test Ingot from Ladle, Per Cent	C, 0.20—0.35 Mn, 0.40—0.80 P not over 0.05 S not over 0.05 Silicon, 0.15—0.35	C, not over 0.30 P, not over 0.08	C, 0.20—0.35 Mn, not over 0.75 P, not over 0.06 S, not over 0.06	Mn, not over 0.75; P, not over 0.05; S, not over 0.05
Physical properties	No physical tests made. Surface inspection before and after machining. Castings true to pattern substantially or within commercial limits and all cores accurately placed. Castings free from injurious defects. Bearing surfaces solid and without porosity in positions where the resistance and value for the purpose intended would be seriously affected thereby. Gates and risers neatly and closely trimmed and castings free from sand, scale, etc.			½-in. diameter x 2-in. L. tension specimen, and ½-in. x 1-in. section-bend specimen are taken from test coupon, 1½-in. x 1½-in. x 5-in., after removal from casting. Tensile strength, 60,000 lb. per square inch minimum. Yield point (by drop of beam), 27,000 lb. per square inch. Elongation in 2-in., 22 per cent. Reduction of area, 30 per cent. Bend specimen, 120 deg. around 1-in. diameter pin.

T-2001

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.—TRAFFORD FOUNDRY

ELECTRIC FURNACE REPORT "Acid" operation. 46.

CHARGE	Lbs.
Foundry Returns	4 300
Light charging scrap	7 950
Steel turnings	3 700
Total	
METALIC ADDITIONS (Per cent carbon / Per cent alloy)	
Carburite	
80% Fe. Mn.	150
50% " Si.	160
Aluminum	2
Total Metal in Furnace at Tap	16 262
Electrodes	
Roof	
Furnace	
Doors	

SHIFT Day | DATE 5/23 1923 | GRADE Steel Castings | HEAT No. 885

ANALYSIS	Cast	C	Mn.	Si	P	S	Cr	Ni	W	Va.
Specified										
Final		.19	.59	.31	.034	.036				
Figured										
Preliminary 1		.16	.09							
" 2										
" 3										

MELTER	TIME	Meter Reading K. W. H.	HOURS For Heat	K. W. Hours Total	K. W. Hours Per Melted	K. W. Hours Ton Good Cast.	K. W. Hours Extra
Start Charging							
Power On	11 AM	788600					
Skim							
Tap	2.30 PM	792350	3½ Hrs.	3750	462		

SLAG MATERIALS	Lbs.
Lime	
Fluorspar	
Carbon-Coke	
Fine Silicom	
Ore	
REFRACTORIES	
Magnesite	
" Cement	
Clay	100
Sand	400
Nozzles 2"	1
Stoppers	1
Sleeves	6
Tiles	

WEIGHT REPORT	Lbs.
Gates and Risers	
Rejected Castings	
Butts	
Skulls	
Pit Scrap	
Total Scrap	
Accepted Castings	
Total	
Total in Furnace at Tap	16262
Difference	

CASTINGS REPORT	No. of Pieces	Size	Total Weight

FIG. 4—ELECTRIC FURNACE REPORT

When operating basic, the following results were obtained on three occasions: (1) Grade—Cast Iron: Charge, 18,036 lb. of cast-iron millings; slag, 100 lb. lime, 432 lb. carbon; length of heat, 4 hr. 15 min.; energy consumption, 625 kw.-hr. per ton melted. (2) Grades—Specimens A, B, C and D steel castings: Charge, 1,820 lb. trimmings, 1,710 lb. sheet, 7,210 lb. foundry returns, 2,430 lb. light charging scrap; metallic additions, 42 lb. carburite, 109 lb. ferromanganese, 108 lb. ferrosilicon, 3 lb. aluminum; slag, 804 lb. lime, 102 lb. fluospar, 72 lb. carbon, 55 lb. fine silicon, 150 lb. ore; length of heat, 3 hr. 50 min.; energy consumption, 700 kw.-hr. per ton melted. (3) Grade—5 per cent nickel steel ingots: Charge. 5,136 lb. 5 per cent nickel millings, 3,086 lb. blades, 2,238 lb. ingots, 100 lb. scrap, 280 lb. lime; metallic additions, 61 lb. ferromanganese, 96 lb. ferrosilicon, 3 lb. aluminum; slag material, 608 lb. lime, 152 lb. fluospar, 12 lb. carbon, 105 lb. fine silicon, 150 lb. ore; length of heat, 4 hr. 15 min.; energy consumption, 1,025 kw.-hr. per ton melted. The form in which these results are recorded is shown above.

Since the purpose of the electrical equipment is to serve faithfully the furnace and enable it to produce steel at the lowest possible power cost, reliability is the essence of the installation, and ruggedness and simplicity of construction and accuracy of control must be its chief characteristics. Switchboard details should not cause annoyance and delay. Controller handles should be substantial, easy to hold with sweaty hands, and where indication of controller position is necessary it should be made obvious from a considerable distance away from the switchboard. Attention should be given to the visibility of meters from operating positions of the furnace men. The rear of control panels must be protected from dirt, dust and mechanical injury amid the strenuous operations of the steel plant and yet must be readily accessible. The graphic wattmeter should be away from access by the furnace operators, preferably in the superintendent's office, as it is a most valuable check on operations. At Trafford the graphic wattmeter was placed on the metering panel in the transformer vault on the gallery, where an automatic furnace regulator was also installed. As this piece of apparatus is so vital in any successful electric arc-furnace installation, it deserves the greatest consideration of all.

Ever since electric arc furnaces have been in commercial use in melting steel, ferro-alloys and non-ferrous metals, there has been a demand for a suitable device to maintain steady electrical conditions in the furnace. The Westinghouse regulator which was selected for this installation may be adapted to any furnace having any number of movable electrodes. Its features are emphasized in Fig. 3.

The regulator can be adjusted to operate when the current varies 5 per cent from its normal value. The utilization of both arc voltage and arc current for controlling the electrode motors prevents the electrodes from getting into the steel under automatic regulation. The regulator is particularly rapid since an electrode speed of 2½ ft. to 3 ft. per minute is possible under automatic control. Current surges are brought back to normal with a promptness which results in a reduction in the demand load, especially when a short demand period is the basis upon which the power company figures its rates. The speed with which settled conditions are attained reduces the over-all time per charge and permits a greater production of metal per hour. The regulator operates at full speed until current is within about 10 per cent of normal, and from there on its speed diminishes to zero as the current reaches normal. This zoning effect is accomplished by means of auxiliary contacts on the main contactors which operate to short-circuit sections of the voltage and current coils of the regulator respectively. High speed, insuring close regulation, is thus obtained without overshooting or hunting.

In early installations it was the practice to control the position of electrodes manually, in order to obtain constant power input as nearly as possible. This manual regulation required the unceasing attention of

one or more men per furnace, depending upon the number of electrodes. An automatic regulator relieves the furnace crew from attention to the regulation of the furnace and allows them to give their entire attention to the metallurgical aspect of melting steel and producing hot metal. This results in a reduction in the number in the crew, particularly if several furnaces are charged and tapped in rotation.

Acid Versus Basic Linings

Whether the furnace lining should be acid or basic is a question which is so essentially tied up with the kind of product desired and with the economics of every installation that careful consideration must be given to it. It is usually considered cheaper to operate an acid electric furnace than a basic, taking account of power and electrode consumption, refractory costs and greater production. In practice, however, the advantage is largely offset by the high price of guaranteed melting stock.

The choice between acid and basic operation depends to a great extent upon whether quantity production or steel of definite and highest quality is desired. There is no question that better steel can be made by the basic process than by the acid process. It is impossible in the latter to make alloy steel with guaranteed results, because the alloys themselves oxidize very quickly. In adding alloys in the ladles it is difficult to obtain uniform results. In basic practice the alloys may be mixed in the furnace. In some respects the basic electric furnace is like the basic open-hearth furnace. It is superior, however, to the open-hearth because of the uncertainty of sulphur elimination in the latter. One difficulty in basic electric furnace practice is the tendency of slag with top pouring to get into the mold. The effect of this upon the steel can be largely overcome, however, by bottom pouring.

Considered from every viewpoint, the question of whether the lining shall be acid or basic is usually decided as follows:

Acid lining should be used when:

1. The sulphur in the scrap employed is, and is likely to continue to be, less than the sulphur required in any castings to be made.
2. The phosphorus in the scrap employed is, and is likely to be, less than the phosphorus required in any castings to be made.
3. When the range of manganese and silicon contents will not be too exacting.
4. When close limits are not set for physical tests.
5. When power consumption must be low and rate of operation is of prime importance.
6. When very small castings in quantity production are to be the sole output.

Basic operation is advantageous when reasons (1) to (4) are opposite to those given above, and when:

1. Alloy steels are ever to be made in the furnace.
2. A steady load is essential.
3. Refining of cast iron is being considered. In making engine cylinders, high-pressure valves, piston rings and parts requiring uniform wearing qualities, a practice now being adopted is to pass the molten iron from the cupola through the electric furnace for a refining period of from twenty to forty minutes, which gives a rapid desulphurization, elimination of occluded gases and an accurate pouring temperature.

It is interesting that during its more than two years of service the Ludlum-furnace installation at Trafford has been successfully operated for different lengths of time in (1) melting down nickel-steel scrap and refining to form ingots with basic lining; (2) melting down miscellaneous steel scrap and refining to form steel castings with basic lining; (3) melting down cast-iron borings and turnings to form iron castings with basic lining, and (4) melting down selected steel scrap to form steel castings with acid lining, (a) at approximately 115 volts, (b) at approximately 128 volts.

When this installation was first planned, only two operations were contemplated—(1) a temporary period and (2) a permanent operating period, during the first nineteen and one-half months of which a basic lining was used. During the latter period 131 heats of nickel steel, six heats of cast iron using cold scrap and one heat of cast iron using hot metal from the cupola were poured. During the period mentioned 492 heats were poured with an average energy consumption of approximately 725 kw.-hr. per ton.

Operating Results Obtained

Steel castings were produced according to four different specifications, as shown in the accompanying tabulation.

TABLE II—COST OF STEEL AT SPOUT FOR MONTH OF FEBRUARY, 1923

Miscellaneous alloys		$531.00
Scrap, etc.		10,642.00
Wages of chargers and helpers		928.00
Salaries of foremen		158.00
Material handlers		528.00
Wages of crane operators		233.00
Fluxes, etc.		72.00
Furnace repairs, including electrodes		2,372.00
Laboratory expenses		312.00
Maintenance of buildings		9.00
Maintenance of cranes		70.00
Depreciation—buildings		23.00
Depreciation—mechanism, transformers and furnaces		169.00
Insurance		6.00
Taxes		40.00
Power, heat and light		4,694.00
General expenses:		
Salaries of superintendents and clerks, furnishings, office expenses, dining rooms, police officers, telephone and telegraph, prorated charges from general books, etc.		302.00
Total defective castings	$372.00	
Miscellaneous small tools	54.00	
		426.00
(Remaining two-thirds against pouring floor)		
Portion of stores		10.00
Total		$21,525.00
Total output, exclusive of melting loss, lb.		929,936
Average cost per pound of steel at spout		$0.0231
Loss, heads, gates, splashings, etc., lb.		324,726
Cost at 0.0125 cent per pound		$4,059.00
Net output, lb.		605,210
Cost per pound of steel in molds		$0.02886

Business depression forced the shutting down of the furnace on Oct. 14, 1921, for fourteen months. When conditions permitted starting again steps were taken to reduce operating costs. It was found possible to buy at reasonable price turnings and light charging scrap of a composition which would analyze before charging less than 0.04 per cent P and 0.04 per cent S. The furnace was accordingly lined (bottom 9 in., sand over 9 in. brick) for acid operation, it being considered that the greatest savings could probably be accomplished by increasing the number of heats per working day and reducing the kilowatt-hours consumed per ton of steel produced. The furnace was started on Dec. 20, 1922, with acid lining for the 631 heat to make steel castings according to specification (D), working upon charges consisting of (a) heavy charging scrap (foundry returns); (b) light charging scrap (plate shearings, small forging stock, 3-in. shells), and (c) heavy short shovel turnings.

The first sixty heats with the "acid" lining were melted with too low an applied furnace voltage. As a result the heats were of unequal and uncertain length. Owing to the condition of scrap and method of charging, high resistance due to non-conducting material under the electrodes caused great difficulty in getting current through the charge at the beginning of a heat. In time the three graphite electrodes of comparatively small diameter in a row would cut a narrow trough down through the metal, establish a longitudinal pool and finally heat and melt the entire mass of metal. Power consumption was practically as great as with "basic" operation and electrode consumption was higher, being around 17 lb. per ton. The electrode cost, at 18 cents per pound, was therefore $3.06 per ton.

The applied voltage was then increased to the maximum obtainable from the transformer and greater care was observed in charging. Markedly improved results were at once obtained. This is indicated by the accompanying furnace report (Fig. 4). Electrode consumption was reduced to 8 lb. or 9 lb. per ton. That is, on the average, one section 60 in. x 10 in. in diameter was added every fourth 8-ton heat. More than 200 heats have been poured under the improved conditions.

A power cost of ½ cent per pound, and an average cost per pound of steel at spout of 2.31 cents, or a net cost in the molds of 2.886 cents per pound, is not what could be called a low cost; but it is unquestionably low for the conditions and indicates a vigilance in management obviously directed toward overcoming the admitted shortcomings of the installation. The particular immediate impediment to reducing cost is lack of pouring-floor space. The furnace operation must be slowed down at present because the floor is unable to take its capacity. This situation will be relieved somewhat, and a lower melting cost should prevail, when the addition to the foundry now under construction, in which small green-sand castings are to be made, is in operation.

In conclusion, the results of operation have indicated that there are two serious defects in the furnace which should be and can be eliminated. One is that the roof does not last so well as the circular roof, and the other is that the electrode masts lack rigidity against side whip. The electrode plants are very satisfactory, but the door construction is very poor. For some unknown reason, the furnace was designed with doors on the chamber side of the furnace wall, so that the ledge is on the outside rather than on the inside of them. Notwithstanding these defects, the installation has been a commercial success. Under the circumstances, a good life of refractories has been obtained.

At last report, about June 1, 1923, the first acid lining was in good condition. A new roof lasts about one month—that is, fifty or sixty heats—before requiring patching. It usually stands patching about twice and lasts in the neighborhood of three months, or a total of approximately 150 heats.

Acknowledgment is gladly made to A. Slusser, J. R. Thompson, superintendent, and D. N. Witman for placing the foundry records at the writer's disposal.

Interconnection Progress in Ohio at 132,000 Volts

Plan Contemplates Connection of Ohio Public Service Company's Properties and Interchange with Neighboring Utilities

BY GEORGE E. SNIDER* AND E. E. SPRACKLEN†

THAT part of the ultimate interconnection of the Ohio Public Service Company's properties lying between Warren and Alliance, Ohio, was completed and placed in operation recently. Interconnection of this

*Chief engineer Ohio Public Service Company, Cleveland.
†Electrical engineer Ohio Public Service Company, Cleveland.

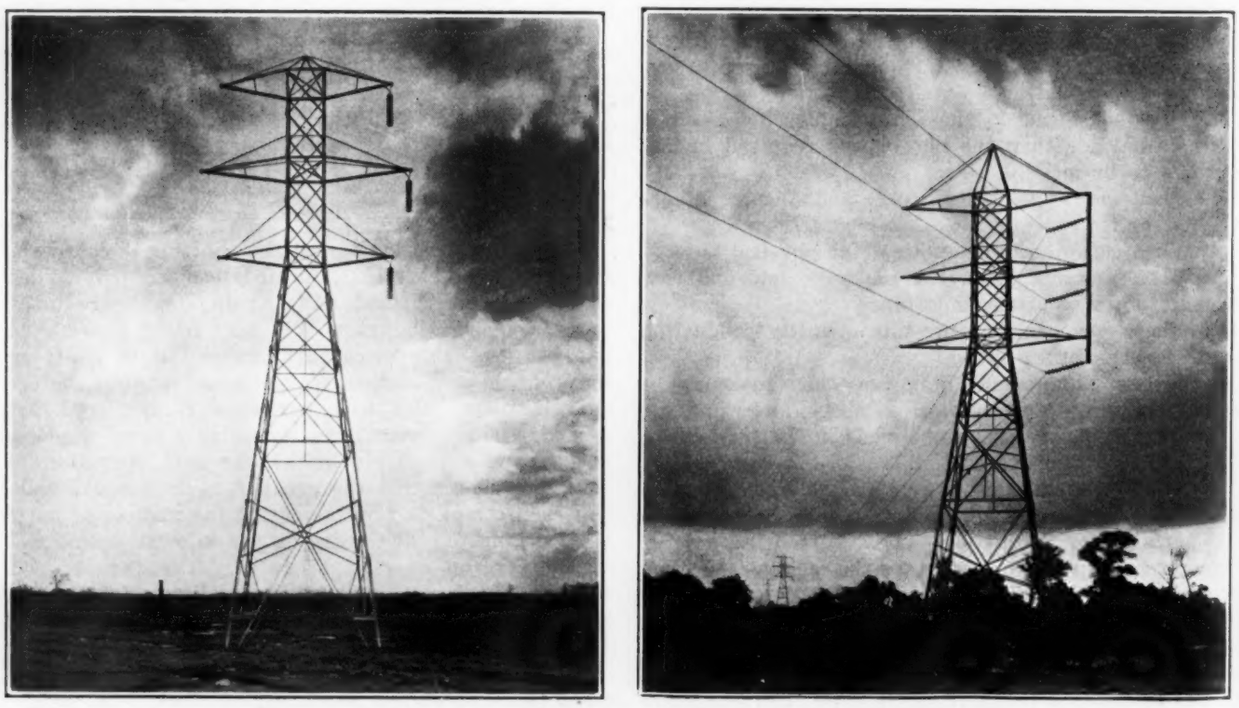


FIG. 1—STANDARD AND ANGLE TOWERS USED ON OHIO INTERCONNECTION

FIG. 2—INTERCONNECTIONS OF THE OHIO PUBLIC SERVICE COMPANY IN OPERATION OR UNDER CONSTRUCTION

section with the Ohio Power Company at Canton and the interconnection between Lorain and Mansfield are now under construction and will be completed soon.

Some idea of the work contemplated may be obtained from a study of Fig. 2, which shows only the proposed interconnections of properties owned and operated by the Ohio Public Service Company and the connections to be maintained with other large utilities of the state for interchange of power. Connection with utilities operating in neighboring states allows for an interchange of power well into Pennsylvania, Indiana and Michigan and will eventually form a large link in a vast superpower system, combining the natural resources of the Ohio River Valley with those of the Great Lakes, to supply the industries and communities throughout Ohio and western Pennsylvania.

Present development includes a double-circuit rigid-steel tower line from Warren through Alliance, Canton, Massillon and Ashland to Lorain, to be operated at 132 kv., 60 cycle, with substations at each point, and a similar line from Ashland to Mansfield for operation at 66 kv. Until the connection between Canton and Ashland is completed, the line between Lorain and Mansfield will be operated at 66 kv. but insulated for 132 kv. from Lorain to Ashland.

The type of towers used is shown in Fig. 1. Standard line towers (type A) are spaced about one-sixth of a mile apart, while strain towers (type B) are erected at all angles exceeding 5 deg. Both types of towers are galvanized and mounted on earth footings. The type A tower weighs 7,600 lb., including earth anchors, and the type B tower 15,000 lb. No strains or semi-strains are employed except at substations, where single-circuit horizontal-spacing dead-end towers are used to obtain proper position for entrance. No ground wires have been installed, although the construction of the towers allows for the installation of one if it is found necessary. The conductors, which have a cross-section of 336,400 circ.mill, have a normal spacing of 22 ft. 6 in. horizontally and 12 ft. vertically, with 2 ft. 6 in. offset of center conductor.

On straight suspension a standard ten-unit string of 10-in. disks is used, while at angles exceeding 5 deg. and at dead-ends a ten-unit string of extra-strength 11-in. disks replaces the usual method of installing double twelve-unit strings of the lighter 10-in. disk. At the conductor end of the string a standard galvanized horn is used to reduce the potential gradient.

All substations along the line are developed from a unit structure and are consequently essentially the same, differing only in the number of lines and the low-tension voltage required for that locality. A typical installation, now in operation at Alliance, is shown in Fig. 3. The steel work is composed of a minimum number of

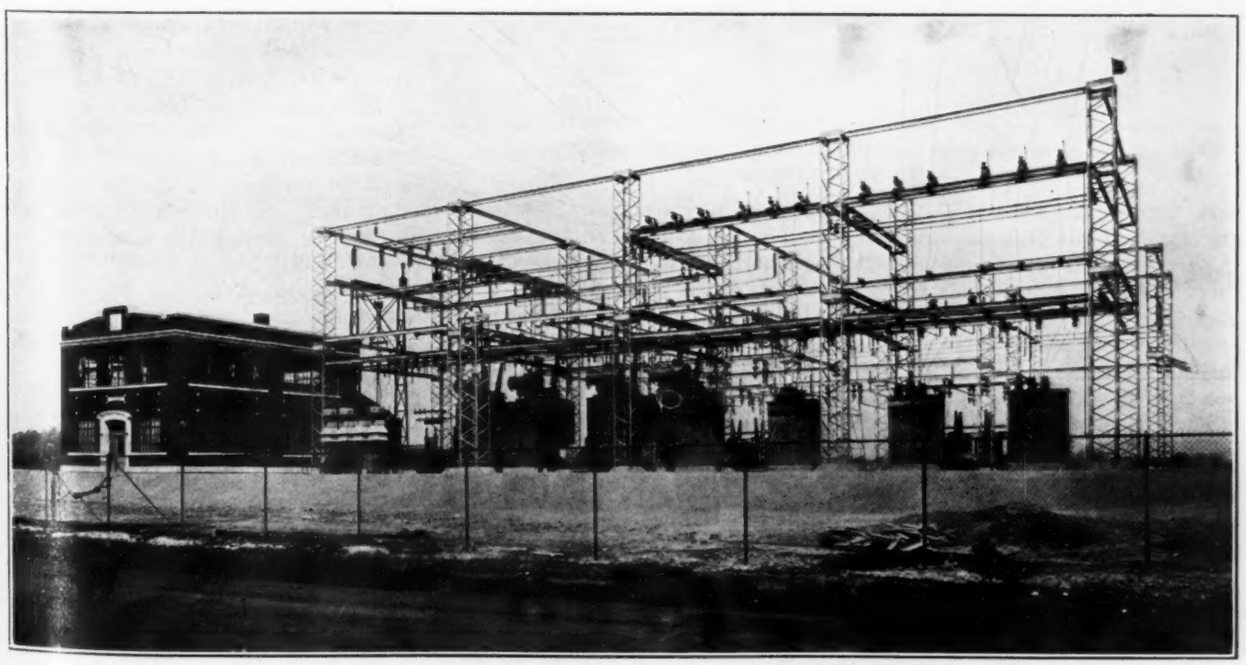


FIG. 3—SUBSTATIONS DEVELOPED FROM UNIT STRUCTURE

standard shapes and is galvanized throughout. All columns are of the same construction, are 30 in. square and extend in two sections of 20 ft. above foundations. This splicing at the 20-ft. elevation allows for the construction of columns 20 ft., 30 ft., 40 ft. or 50 ft. in height, reduces the length of members to permit galvanizing and purchase from any manufacturer, and reduces shipping damages and delay and cost of erection. Each column is erected on angles cast into a concrete foundation, instead of following the usual bolt-and-plate construction, and each leg is fabricated to permit the bolting of the supporting angles for all cross-members at the several heights determined for all voltages between 22,000 and 132,000. The cross-members are standard 8-in. I-beams and, owing to the method of fabrication, are interchangeable throughout the structure. By the use of standard shapes for all pieces the purchasing field has been broadened. By the use of a few interchangeable parts, with additional fabrication, instead of special fabrication for each part, erection has been greatly simplified and costs reduced.

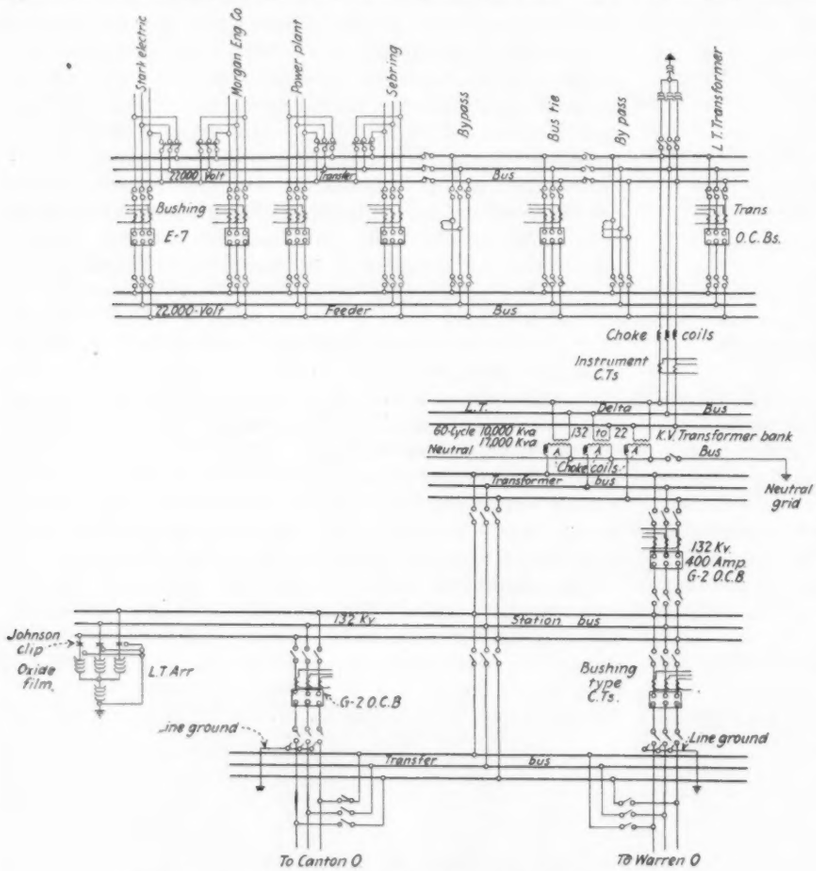


FIG. 4—SUBSTATION SWITCHING FACILITIES THAT AFFORD FLEXIBILITY OF OPERATION

Further to reduce costs of erection and reduce steel details all insulators, bus supports and disconnecting switches, except 132-kv. "disconnects" and air-break switches, are mounted on the cross-members with clamps. All beams are drilled for mounting the 132-kv. switches with 8-ft. 6-in. spacing between phases and 5 ft. to ground, and the 132-kv. bus supports and insulators are clamped to the beams at the same spacing. For lower voltages and lighter switches the clamping feature allows for easy changes, variable spacing and the use of the same steel employed in the high-voltage structure. Very rugged construction is obtained without the use of special clamps or any special work at any point in the construction.

Bus supports for all voltages consist of standard strings of 10-in. suspension-disk insulators held in the vertical position. Single-pole, single-throw inverted "disconnects" are used and mounted so that all blades are easily accessible for hook-stick operation; when closed the switch hook is not more than 17 ft. 6 in. above the ground. A grounding switch for each 132-kv. line has been adopted, using the blades of an air-break switch mounted on an operating shaft. It is operated by a standard mechanism and makes contact with an auxiliary clip on the line side of the first set of "disconnects" in each line bay. All air-break switches are hand-operated and break vertically.

By the use of galvanized angles for bus conductor it has been possible to relay on bus supports at each end of the bays with no intermediate supports, thus accomplishing a decided saving in insulators and steel work with the use of a suspended bus. The cross-section of the steel in these buses is such that they have current-carrying capacity approximately 75 per cent greater than No. 4/0 copper wire and can easily be reinforced for higher capacities. Connections between buses are made with No. 4/0 stranded copper and large tinned lugs are bolted to the angles. The lugs are made of $\frac{3}{4}$-in. standard copper tubing cut and formed to meet the conditions. Connections between buses and disconnecting switches are the same except that extra flexible No. 4/0 copper wire is used.

Any breaker may be removed from service and inspected without an interruption, using a spare breaker or manipulation of air-brake switches and oil circuit breakers. (See Fig. 4.) A spare or bus-tie breaker is maintained on the 22,000-volt side of the transformer bank which may be used to replace any feeder breaker or the transformer breaker. No spare breaker is used on the 132-kv. side, but by closing the line air-break switches the line is made continuous through the station and any of the three breakers may be used for transformer protection. Normal operation requires the use of all three breakers to clear trouble on either line and the transformer bank.

Transformers are connected 132 kv. star to 24,000-volt delta with a "disconnect" in the neutral ground on the high side to allow for operation according to the most favorable conditions. The design of these transformers is such that they have a rating of 10,000 kva. self-cooled, and by the application of water through the cooling coils the rating is increased to 16,800 kva.

Lightning arresters are installed on the main station or transformer buses. Oil circuit breakers of the highest rupturing capacity and most modern design and the switching schemes employed provide ample means for protection and restoration of service.

Equipment Failures in England

FOR MANY years the British Engine, Boiler & Electrical Company, Ltd., has published a technical report of equipment failures that have come within the company's experience. A brief digest of parts of the 1922 report, just issued, should prove interesting to American readers.

Turbine Failures

1. Rateau type, 5,000 kw., operating at 3,000 r.p.m. After five months' operation a crack occurred in the hub which originated in the keyway.

2. Impulse type, 5,000 kw., operating at 3,000 r.p.m. Complete wreck resulted from a crack in the first wheel due to metal fatigue, after twenty-six hours' operation.

3. Rateau type, 6,000 kw., operating at 3,000 r.p.m. After seven months' operation a piece came out of first-stage wheel owing to vibratory stresses set up by partial steam admission.

4. Impulse type, 3,000 kw., operating at 3,000 r.p.m. After nine months' operation machine failed when vacuum was lost under load because changing to atmosphere caused unequal expansions due to increased heat and guide blades made contact with revolving parts.

5. Curtis-Rateau type, 3,000 kw. After one month's operation manganese-bronze paddlewheel casting on low-pressure water seal failed and caused damage.

6. Reaction, geared type, 700 hp., 5,000 r.p.m. After operating since 1915, machine failed owing to rubbing caused by bearing failure.

7. Two units, 5,000 kw. each, 3,000 r.p.m. Failed quickly owing to trouble caused by Mitchell thrust bearings, causing running of the white metal pads; causes indefinite.

Turbine-Driven-Generator Failures

1. Rated at 8,000 kva., 7,500 volts, 50 cycles, 3,000 r.p.m. Short circuit on line resulted in burning of machine through arcing between adjacent turns of one phase.

2. Two units, 15,000 kva. each, 6,500 volts, 25 cycles, 1,500 r.p.m. One burned after three months' operation. Vibration of stator-core bolts caused breakdown of ½-in. micarta tubes; insulation failed and arcing resulted. The other unit failed in a similar manner after one week of operation.

3. Rated at 5,000 kva., 6,600 volts, 30 cycles, 1,800 r.p.m. Burned after one year's operation. Failure of insulation of stator winding caused by dirt and moisture allowed arcing to occur.

4. Rated at 23,500 kva., 6,600 volts, 50 cycles, 1,500 r.p.m. Rotor became grounded after operation for eight months; windings very dirty.

5. Rated at 6,000 kva., 6,600 volts, 50 cycles, 3,000 r.p.m. After eleven months' operation rotor insulation became low. Dirt and moisture caused trouble.

6. Rated at 12,500 kva., 3,000 r.p.m. After three months' operation rotor became grounded because of mechanical collapse of end turn of the windings.

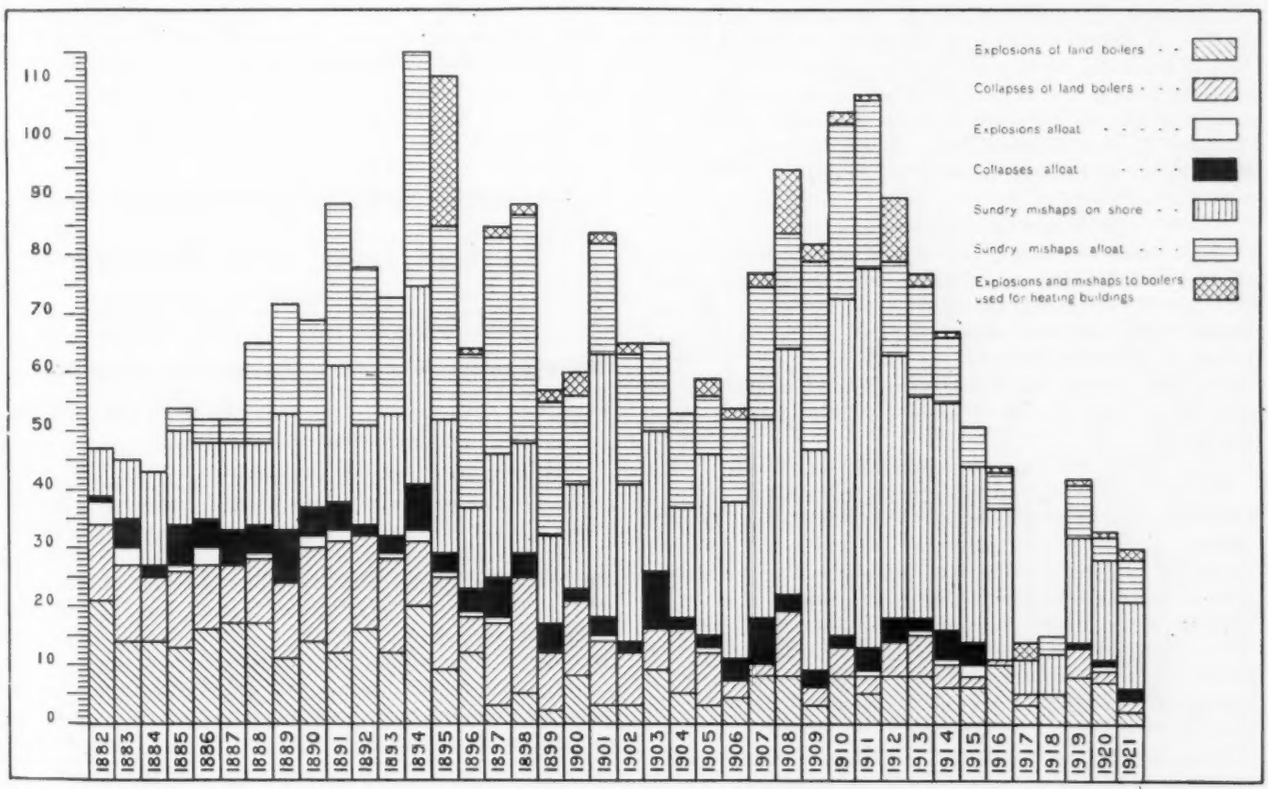
7. Rated at 8,000 kva., 2,500 volts, 1,500 r.p.m. After six months' operation stator ground occurred as result of failure of insulation because of mechanical abrasion caused by movement of stator bars in the slots.

8. Rated at 5,000 kva., 11,000 volts, 1,500 r.p.m., 25 cycles. Stator grounded in eight months because of movement of core stampings causing cutting of coil insulation.

9. Rated at 1,000 kva., 3,000 r.p.m. Failed completely in six months owing to bursting of cylindrical manganese-aluminum brass end rings. Stress due to centrifugal force less than four tons, and examination showed coarse grain structure, oxide occlusions and shrinkage cavities.

10. Rated at 15,000 kva., 11,000 volts, 2,000 r.p.m., 33.3 cycles. Owing to closure of main switch to bus while machine was at rest arcing occurred between nickel-chrome end rings and slot wedges.

11. Rated at 7,500 kva., 11,000 volts, 3,000 r.p.m., 50 cycles. Operator closed main switch to bus with machine stationary and no excitation. Rotor came up to speed as induction motor, but heavy currents caused the phosphor-bronze slot wedges to buckle.



FROM ENGLISH "BOARD OF TRADE ANNUAL" RECORDS OF EXPLOSIONS ON BOILERS IN MANY TYPES OF WORK ARE GIVEN

Other Electrical Machinery

Seventeen failures of other electrical machinery are listed and described. The machines considered were motors, generators, motor-generators and rotary converters. An analysis of the failures on a proportional basis is given in the following table:

	Per Cent
Armatures and rotors	38.3
Field coils and stator windings	18.1
Commutator, brush rigging and slip rings	12.1
Miscellaneous	11.4
Starters	20.1

Heavy Loss to Industry Is Caused by Fatigue of Metals

FATIGUE of metals has caused an estimated loss of millions of dollars annually to American industry, according to a report to the Engineering Foundation and the National Research Council by Prof. H. F. Moore, who has been conducting an investigation at the materials-testing laboratory in the University of Illinois. Losses are caused not by spectacular disasters but by large numbers of minor accidents.

Dealing with economies possible of accomplishment as a result of the investigation, which has been in progress more than three years, Professor Moore says that losses might be cut 50 per cent. The report adds:

"In estimating the damage done by such failures probably the largest item of cost is the loss of service caused by idleness of machines during replacement of broken parts. A detailed study of the above causes of failure would in itself be a considerable investigation, but it does not seem unreasonable to estimate the total loss per year due to the above causes as several millions of dollars. It would seem that a careful study of the phenomena of fatigue failure might reduce this loss at least 50 per cent.

"This study would not only cover a study of the properties of ferrous metals, but would also include a study of the stresses set up in parts with irregular shapes. The loss by actual fatigue failure is, however, only one phase of the problem. Another phase, probably of equal financial importance, deals with the possibility of using in stress-carrying machine parts metals which are not now used because their fatigue-resistance properties are not known."

Two illustrations are given by the report as follows:

"It would be very desirable in many cases to use non-corrosive, non-ferrous metals for making steam-turbine blades. At the present time the fatigue-resisting properties of non-ferrous metals are almost entirely unknown, and, as a turbine blade is subjected to prolonged fatigue stress, the non-ferrous turbine blade has a rather limited use. A study of the fatigue-resisting properties of non-ferrous metals might enable a great saving in the cost of operating steam turbines to be made.

"The use of steel castings to replace expensive steel forgings is becoming more and more common. One of the great drawbacks to the use of steel castings is a lack of knowledge as to their fatigue-resisting qualities. It is a well-known fact that a steel casting with the same chemical composition as a steel forging may have quite different strength properties. A study of the fatigue strength of steel castings offers a promising field for the further extension of the use of steel castings and for the reduction of cost of complicated steel parts.

"During the past year the investigation of fatigue of metals has been in full progress. The main lines of work covered are: (1) The investigation of fatigue of wrought ferrous metals under cycles of stress repeated but not reversed; (2) study of the effect of heat treatment on fatigue strength of steel; (3) obtaining of further evidence for the existence of a definite endurance limit for wrought ferrous metals, and (4) the beginning of work on non-ferrous metals.

"Under (1) a fairly extensive series of experiments has been made, a tentative formula developed for various ranges of stress and a second series of experiments begun. These experiments have involved the design and construction of a new type of fatigue-testing machine. Under (2) heat treatment surveys of several steels have been carried out, including fatigue tests. Under (3) additional long-time test data have been accumulated, including one test of steel carried to one billion repetitions. There has been observed a distinct increase of endurance limit in steels subjected to millions of repetitions of stress below the original endurance limit. Under (4) fatigue tests on monel metal are now in progress.

"During the year the investigation has been financed almost entirely by the contributions of the General Electric Company. Contributions from the Allis-Chalmers Company, the Western Electric Company and the Copper and Brass Research Association have just become available, and a study of fatigue failure of non-ferrous metals will be a major feature of the investigation in the immediate future."

Reports of the progress of this investigation have been given in Bulletins 124 and 136 of the Engineering Experiment Station of the University of Illinois and in Publications 4 and 6 of the Engineering Foundation.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Familiarizing Lighting Customers with the Kind of Supply Available to Them

To the Editors of the ELECTRICAL WORLD:

W. O. Batchelder of our Chicago office has recently made a suggestion to me which I think is well worthy of being passed on to you. The suggestion was based upon a letter by J. H. Meehan, appearing on page 78 of the issue of the ELECTRICAL WORLD for July 14 last.

It is a fact that a large amount of correspondence is frequently necessitated and delays are encountered because prospective buyers of electrically equipped household utilities are not able to give information as to the current supply available. Mr. Batchelder suggests that electric light companies have prominently printed on their bills a statement indicating the nature of the electric supply—alternating-current or direct-current, single-phase, two-phase or three-phase, the frequency and the voltage available. If such a legend were prominently printed on all bills, it would seem that the customers of the central-station company would, because of the constant repetition of the information, soon become familiar with the characteristics of their current supply.

FRED M. KIMBALL,
Manager Small-Motor Department.
General Electric Company,
West Lynn, Mass.

A Protest Against the Seven-Day Working Week

To the Editors of the ELECTRICAL WORLD:

I have read your editorial in the Aug. 4 issue wherein you voice a plea for the college-bred engineer. About three years ago I was graduated from one of the large universities and then entered the power-house game. I was fully aware of what was before me in the way of long hours, steady work, ceaseless routine, dirt and prejudice against college men. However, a lot of poor

neophytes still under the watchful care of their beloved professors are not so well informed; hence this letter.

In all justice, the N. E. L. A. committee should tell the bad as well as the good side. The hardest part of the work is the remorseless seven-days-a-week, three-hundred-and-sixty-days-a-year grind. The strain of this will not be so apparent the first year, but after that it becomes, well, monotonous to say the least. One becomes stale, has little time for recreation and will gradually get out of touch with young people (assuming that the graduate is young, as are most). This is a bad thing. Friends ask, "Where is so and so?" and the reply comes: "Oh, he is in a power house and has no time for us any more."

My company has treated me very well, but oftentimes I ask myself whether I would not be just as well off in some other industry. So I ask you to state both sides and to urge the N. E. L. A. to start a movement for a six-day instead of a seven-day week, thereby doing a great thing for the industry. A YOUNG ENGINEER.

The Catalina Island Cable

To the Editors of the ELECTRICAL WORLD:

I have recently had my attention called to an erroneous statement appearing in the ELECTRICAL WORLD for Aug. 11, page 305, relative to the new Catalina Island cable. As yet no attempt has been made to apply carrier-current telephony to this system. There are two one-pair cables in operation, each of which is now capable of but one speech channel. In addition to the telephone circuit each cable is composited to provide a duplex telegraph channel. G. C. SOUTHWORTH.

American Telephone & Telegraph Company,
New York, N. Y.

Doubts Advisability of Explanatory Articles on Theft of Electricity

To the Editors of the ELECTRICAL WORLD:

In your Aug. 18 issue I find the article on "Preventing Theft of Electrical Service," by Ralph Pittman, on pages 342-344, very interesting. There is doubtless a question in the minds of some as to the advisability of publishing an article of this kind. Certainly we would not expect to find the newspapers publishing recipes for the distillation of illicit liquor, yet probably there might be some who would be greatly pleased by the appearance of such an article. Similarly there are doubtless some who are displeased and some who are well pleased with the publication of Mr. Pittman's article. It undoubtedly is of great merit and he has handled his subject ably, showing that he has had experience in dealing with electrical thefts.

In Case 8 he describes one condition for which the central station itself is usually to blame, and his description is very clear, but it is unfortunate that the figure which illustrates this condition (Fig. 6, page 343) is improperly labeled. According to Mr. Pittman's description in Case 8, Fig. 6 shows connections which he cautions against. It would seem that Fig. 6 should be labeled "*Improper* Connection for System with Grounded Neutral."

It is pleasing to note that the cases described by Mr. Pittman are altogether those which are illustrated by old forms of open service. To the uninitiated it should be said that such forms as illustrated do not represent present-day meter practice, and I think the recommendations in each case made by Mr. Pittman are covered by the use of present-day service and meter appliances.

It is to be hoped that the ELECTRICAL WORLD reaches a class of subscribers of such high order that no misuse will be made of information such as is set forth by Mr. Pittman. R. C. FRYER,

Union Gas & Electric Company, Superintendent Meters.
Cincinnati, Ohio.

[Mr. Fryer has very well covered the several policy angles introduced by the publication of the article by Mr. Pittman. Each case of possible theft is also accompanied by a remedy. The error is ours in Fig. 6, and its discussion should be based on "improper" ground connection.—EDITORS.]

Danger of Hasty Generalizations from Line-Material Tests

To the Editors of the ELECTRICAL WORLD:

Too little is published along the lines of the article on "Tests of Line Materials," describing work done by H. P. Seelye of the Detroit Edison Company, published in the ELECTRICAL WORLD for Aug. 25, page 379.

A word of warning should, however, be given readers as to drawing hasty conclusions from tests of this nature. The author of the paper has been conservative throughout, but the general reader will often attempt to prove too much from limited data.

A test of this kind on articles of wood, such as insulator pins, is affected by a large number of variables each of which may have a very wide range. Because of the number of variables it is not always possible, in making the test, to follow very closely the exact conditions of use of the article, if some variables can be eliminated by testing under other conditions.

To illustrate this point, I may refer to a test made by the Public Service Electric Company on 540 locust insulator pins a number of years ago to determine pin strength. In order to eliminate the effect of variations in the material of the cross-arms or the distortion of the pinhole, after repeated tests, cast-iron blocks with holes of slightly different diameters were used to hold the pin so that pins with slight differences in shank diameter might all have a snug fit.

Three lots of approximately 180 pins each were tested with the load applied at the following angles to a line tangent to the annual rings: 0 deg., 45 deg. and 90 deg. The resulting average breaking moments were respectively 5,291, 5,138 and 5,090 inch-pounds.

As regards annual rings, the pins varied from three to eighteen rings per inch, averaging eight. We were somewhat surprised to find that with 540 specimens tested there was little if any difference shown between pins from stock of slow and those from stock of fast growth. It was noticed that many of the imperfections which were visible, such as knots, sapwood, wormholes, etc., appeared to have virtually no effect on the initial strength of the pins. Such defects are, however, objectionable in service owing to the shorter life of the defective pins.

The test convinced us of one thing, namely, that to be able to justify any definite conclusions from tests of pins it would be necessary to use a very large number of specimens. H. S. VASSAR,

Laboratory Engineer.

Public Service Electric Company,
Newark, N. J.

Central Station and Industrial Practice

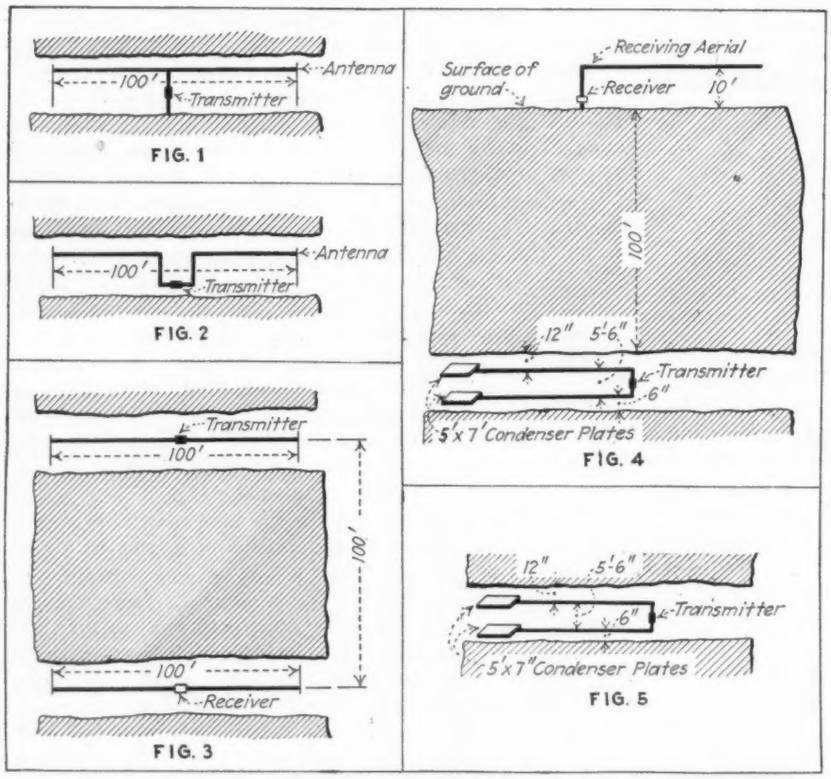
Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Underground Signaling with Radio

EXPERIMENTS with radio communications in a coal mine have been made recently by the Bureau of Mines in its experimental mine at Bruceton, Pa., under the supervision of C. L. Colburn, C. M. Bouton and H. B. Freeman. Although the methods employed in the preliminary experiments proved to be unsuitable for underground communication, they did show that electromagnetic waves may be made to travel through solid strata. The absorption or loss of intensity with distance is very great for the short wave lengths used in these experiments, (200 m. to 360 m.). Longer wave lengths are known to suffer less absorption and may possibly be found effective under certain conditions.

The experiments conducted consisted in receiving signals from without the mines and in both sending and receiving messages underground through the strata. It was found that with a receiving instrument set at a point 100 ft. underground signals from a broadcasting station 18 miles distant could be heard distinctly. The receiving of these signals was aided by some electric light wire extending from outside the mine to within 50 ft. of the instrument. The presence of these wires did assist materially in receiving, for when the set was carried to another point in the mine removed from wire and tracks the signals were much fainter. The fact that signals were detected, however, even though faintly, is sufficient evidence of transmission through the ground to encourage further experimenting.

In sending waves underground it was found that signals could be heard distinctly through 50 ft. of coal strata, but that the audibility fell off rapidly as this distance was increased. In all experiments the vertical antenna was found to give the best results. The horizontal antenna gave practically no reception, while a loop of a single turn was used with fair results. All of these experiments were tried with a wave length of 200 m. to 300 m. with the exception of the broadcasting station, which was 360 m. The strata of the experimental mines lies almost horizontal, and the direction of strata may have some influence on the transmission of radio waves, but the present experiment gives no conclusive evidence on this point.



EXPERIMENTS SHOW THAT ELECTROMAGNETIC WAVES MAY BE MADE TO TRAVEL THROUGH THE EARTH

Signals from the vertical oscillator shown in Fig. 1 were weak at a distance of 320 ft. increasing in intensity until they were very strong at 50 ft. In these tests open entries led from the transmitting to receiving station, but one or more right-angle turns always intervened. With no vertical component in the receiving antenna no signals could be received.

When a horizontal oscillator with a vertical section was employed such as is shown in Fig. 2, the signals were good at a point 100 ft. directly down the entry from the sending instrument. In this case the receiving antenna extended horizontally from the instrument in opposite directions and in a direction perpendicular to the transmitter. At a distance of 100 ft. laterally from the sending apparatus with coal walls intervening, the signals were very faint. This arrangement is shown in Fig. 3.

In another experiment utilizing a vertical oscillator with 5 ft. x 7 ft. condenser plates, Fig. 4, signals could be heard at a distance of 50 ft. in a direction approximately at right angles to direction of transmitter.

When the receiving antenna was located 750 ft. from the transmitter, outside of the mine, signals could be faintly heard. The receiving instrument was then taken to a point directly above the sending instrument, Fig. 5, where signals could be heard.

Wet Straw Aids Blasting Machine Foundation

By H. A. Fee

President Citizens' Light & Power Company, Adrian, Mich.

WHILE blasting out 30 cu.yd. of concrete foundation in the power house of this company without interfering with turbine operation, it was found that gunnysacks filled with straw and thoroughly wetted served most effectively in deadening the shocks of explosives. The foundation was being removed in order to provide room for a new 2,000-kw. turbo-generator. When the work first started we used wooden beams and tarpaulin—but these materials were not satisfactory as they tended to fly around too

freely, threatening to interfere with the turbines in operation alongside. When wet straw was used, the foundation—8 ft. in depth—was safely removed. An 8-ft. fence around the excavation helped to prevent small pieces of concrete getting out of bounds.

At one time we ran out of electric caps and were forced to use fuse caps, which were uncertain and slow. After a little experimenting we converted the fuse caps into "electrics," using two pieces of ordinary bell wire of desired length. These were bridged together with ½ in. of 1-amp. fuse wire soldered on. The two wires were separated with a small piece of tape pushed down so that the fuse made a short loop below the ends of the wires. They were taped together and pushed into the fuse cap so that the fuse wire touched the fulminate, and a little paper was packed in to keep the wires from coming out of the cap. The shots were then fired from the 110-volt station supply.

Layout of Secondary Networks

Methods of Ascertaining Load—Effect of Demand and Diversity Factors on Wire and Transformer Sizes—Calculating Consumers' Demand

FEATURES of construction and operation which have a definite bearing upon the design of secondary systems were outlined by C. A. Bacon of the engineering department of the Adirondack Power & Light Company at the last convention of the Empire State Gas and Electric Association at Utica, N. Y. The more important features of this paper are given below.

The first step in planning the reconstruction of a distribution system is to obtain some idea of the load to be provided for. This information is obtained by a field survey of the system, using a white print of an ordinary street map of suitable scale. Poles are located, and the number of services from each pole, with the connected load of each, is shown. Residence loads are estimated, while exact data are obtained on heavier loads, such as stores, churches, etc. These loads are expressed in equivalent 40-watt units (for example, a connected load of "20" would indicate 800 watts), and each residence outlet is assumed to have an average connected load of 40 watts.

The problem of wire sizes and transformer sizes necessarily brings up the question of demand and diversity factors, which ordinarily with accurate records of tests and data on distribution lines could be settled without an excessive amount of consideration. In some cases, however, no such records are available and values must be temporarily assumed.

In considering the demand of each individual residential customer, the Adirondack company uses the "sliding scale" of demand factors which is shown in Table I. The diversity factor was somewhat more of a question. This company is working at the present time upon an assumed factor of 2.5 (40 per cent), which is considered as an average for the residential districts. This factor will in all probability run high at a 5-kva. installation, be approximately correct at 7½ kva. and somewhat low at 15 kva. These transformer sizes cover the majority of the residential installations. Above 15 kva. the diversity factor will increase to 3 (33 per cent) and 3.50 (28.5 per cent). For determining transformer sizes and for checking purposes the table of transformer sizes as shown in Table II is used. Heavily loaded districts, such as business sections, are treated as individual problems, the demand loads being higher and the diversity less than in residential districts.

Using these values as a working basis, the company then proceeds with the determination of wire and transformer sizes. From inspection of the load map the logical and most advantageous transformer locations are determined, considering the load center, the most advantageous primary routing and the economical side of the question. Calculations are tabulated in a form similar to that shown in Table III. Loads are listed in the first column in groups, each group representing a pole. The fourth column gives the drop per 500 ft. of two No. 6 wires. This is obtained by use of a constant, *K*, which has been evolved to simplify the work. It converts kilowatts diversity to amperes diversity and multiplies this value of the impedance drop per 1,000 ft. of single No. 6 wire. The fifth column gives the distance from the transformer to the load multiplied by two, in feet. Column 6 is the product of column 4 by column 5 and shows the drop of two No. 6 wires at 115 volts. All calculations are made on this basis and are converted to the larger wire sizes by use of the percentage values shown in Table IV.

Where the layout is so arranged that the secondary wire almost completely encircles a block it may be extended one or two pole spans, as may be necessary, to complete the secondary "ring." This method offers an advantage equivalent to

TABLE I—DEMAND FACTORS USED IN CONSIDERING THE DEMAND OF EACH INDIVIDUAL RESIDENTIAL CUSTOMER

Connected Load		Demand Load	
40-Watt No. of Units	Kw.	Per Cent	Kw.
1 to 6	0.04 to 0.24	100	.....
7	0.28	90	0.252
8	0.32	88	0.282
9	0.36	86	0.310
10	0.40	83	0.332
12	0.48	73	0.350
15	0.60	67	0.402
18	0.72	59	0.425
20	0.80	57	0.455
25	1.00	53	0.530
30	1.20	50	0.600
35	1.40	48	0.670
40	1.60	46	0.735
45	1.80	43	0.770
50	2.00	40	0.800

TABLE II—TRANSFORMER SIZES FOR VARIOUS NUMBERS OF CUSTOMERS

No. of Customers	Transformer Size, Kva.	No. of Customers	Transformer Size, Kva.
8	1½	150	15
15	3	250	25
25	5	375	37½
50	7½	500	50
70	10		

TABLE III—CALCULATIONS FOR DETERMINING WIRE SIZES FOR DISTRIBUTION SECONDARIES

(1)	(2)	(3)	(4)	(5)	(6)
Connected Load 40-Watt Units	Kw. Demand,	Diversity	Col. 4 × K	Distance (Ft.) × 2	Drop on Two No. 6 Wires, Volts
12–15–15–25–25	2.164	0.870	3.30	200	0.660
25–30–30	1.730	0.690	2.63	400	1.052
12–12–15–20–20	2.012	0.804	3.06	600	1.836
15–15–15–18–18	2.481	0.992	3.77	800	3.016

Drop on two No. 6 wires = 6.6 volts. Drop on three No. 6 wires = 3.3 volts. Drop on two No. 6 wires with No. 4 neutral = 3.3 × 671 = 2.22 volts.

TABLE IV—CONVERSION FACTORS FOR TABLE III FOR OTHER SIZES OF WIRE

Wire Size	Conversion Factor	Wire Size	Conversion Factor
No. 6	1.000	No. 2/0	0.320
No. 4	0.671	No. 3/0	0.293
No. 2	0.468	No. 4/0	0.273
No. 1/0	0.356		

heavier copper and a smaller voltage drop.

In laying out a secondary system good judgment in estimating future load growth is an important factor. Allowance should be made for future building in the newer sections and for increased load due to an increased demand of the present customers. This provision applies, of course, only to the wire, the transformer size being selected for the present connected load.

The above has shown the method of calculation. The details, however, can be eliminated in many cases where there is a uniform type of load. Take, for example, a section of a city which is composed almost entirely of two-family houses, each flat having an average connected load of 18-watt to 40-watt units, or 720 watts. Calculations may be made on this load basis, indicating the number of pole spans each way from the transformer that it is possible to run with various sizes of wire, keeping within the maximum voltage drop. With these typical calculations, and by referring to the load map to check unusually heavy loads, it is possible to lay out the secondary wire using only a scale. Transformer sizes are selected to agree with Table II. In this way greater rapidity in layout work is obtained with no appreciable decrease in accuracy.

In presenting these methods of secondary distribution design it should be kept in mind that they are not intended as a criterion, but merely as an example of the methods temporarily employed by a company handicapped by a lack of reliable local data. It is intended to make extensive tests on the various distribution systems to check these values as soon as this can be arranged. The factors and methods now used will then be corrected to conform to local conditions, as indicated by the results obtained.

Protecting Men Against Danger in Central and Substations

By P. W. Eberhardt
Safety Supervisor, Substations Department, Duquesne Light Company, Pittsburgh, Pa.

FOR protecting workmen in the vicinity of electrical equipment the General Safety Committee of the Duquesne Light Company has issued to its operators and foremen in charge of construction the accompanying set of regulations. The rules apply particularly to workmen employed around a substation in construction work, who may be totally in ignorance as to the dangers that may be encountered. As will be seen, the foreman in charge is accountable for the enforcement of the regulations.

Emphasis is placed on the handling of parts of unusual size such as ladders and boards. Another source of danger is in working around live lines or equipment where sufficient clearance is not available. In this case provision should be made to have the lines or equipment taken out of service. When there is any reasonable doubt as to the safety of a workman all lines or equipment in the immediate vicinity should be taken out of service, making tests to determine that such equipment is actually dead before allowing the work to proceed.

Tests on an English 33,000-Volt Cable

ONE of the largest 33,000-volt cables now installed in the British Isles is one of the Clyde Valley system which is used as an interconnecting link between the Yoker and Clyde Mill power stations.

Regulations for the Performance of Construction Work in the Vicinity of Electrical Equipment

1. The foreman in charge of the work shall be responsible for enforcement of all rules and regulations for safeguarding the workmen. He shall insist upon necessary assistance from the operating department interested in order that proper measures may be taken to insure the safety of the men.

2. All ordinary working precautions shall be followed as usual, such as guarding against stumbling, slipping, falling articles, loose clothing, provision for eye protection, etc. Adequate light shall be insisted upon in all cases.

3. No construction work shall be started in connection with any station or line without the knowledge and permission of a responsible person in the operating department, at which time application shall be made for special instruction and for supervisor, as provided below. Particular instructions regarding danger points and working methods must be given by a competent person before work is started.

4. No member of a construction gang shall at any time attempt to operate any electrical apparatus except that a properly qualified person working with such a gang may be detailed to do such work by special instruction.

5. When work must be done in the vicinity of normally live parts or conductors two or more men must be present.

6. No construction work shall be done on or around live lines or equipment unless there is sufficient clearance to enable the men to work freely without taking extraordinary precautions to keep clear of such parts. This is understood to mean that sufficient space must be provided for the safe handling of tools and apparatus used in connection with the work. When such clearance is not available arrangement must be made to take the line or equipment out of service.

7. In any case where there is in the mind of the foreman any reasonable doubt as to the safety of the men, or at any time by special request, a supervisor shall be provided by the operating department, who shall be responsible for taking the lines or apparatus out of service, making tests to determine that such equipment is actually dead, and placing special protective devices applicable to the work in hand and the supervision of the men in their movements in and about the lines or equipment. The supervisor may at the discretion of the foreman be required to remain at the location during the progress of the work. After completion of the work said supervisor shall be responsible for removal of safeguards and protective devices, and restoring the equipment to normal condition.

8. Where clearances are ample for ordinary methods and tools and the work is performed in accordance with above provisions, special care must nevertheless be used in handling parts of unusual size. This applies particularly to handling of pieces of great length, such as ladders or boards. Sufficient help must be used in such cases so that the pieces can be handled easily and in such a manner that an unbalancing of the person handling the piece will not throw it into dangerous proximity to live parts. For such work the practice is recommended of having two men handle the piece.

9. When live parts are in the vicinity warning signs must be placed in addition to those permanently fixed thereon, whenever possible.

10. If workmen leave the vicinity of the work for long periods, check must be made on their return to determine that conditions are the same as when leaving and that it is safe to proceed with the work.

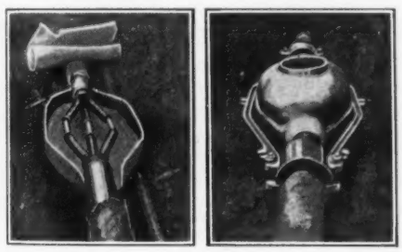
11. Upon completion of new construction work, and when tests are to be made upon the new equipment, arrangements shall be made to clear the line or lines feeding new apparatus and energize equipment from the source if possible. In all cases the premises shall be vacated by all except the person or persons required for the actual operation.

This three-core cable, shown in the accompanying illustration, was constructed by the Pirelli General Cable Works, Ltd., each core being of 25,464 circ.mil cross-sectional area, with round conductors and paper-insulated. The three cores are laid up with impregnated paper fillings, covered by a further belt of impregnated paper, then lead-sheathed, compounded-jute-served, double-steel-tape-armored and compounded-jute-served over all. The cable is built for a working voltage of 33,000 with the neutral of the system grounded.

The cable was manufactured in lengths of 200 yd. to 220 yd., the total length of the line being 15½ miles with a weight of 38.5 tons per mile. The over-all diameter of the cable was 3.55 in.

The following tests were taken at the factory on each length during the lead-cased stage:

1. Insulation resistance measured with 400 volts direct current after twenty-four hours' immersion in water. The average result obtained was 250 megohms per st/ml.
2. Inductive capacity measured between one core and the other two and ground with 400 volts direct current. The average result was 0.29 microfarad per st/ml.
3. Conductor resistance checked after twenty-four hours in water.
4. Each drum of cable was tested with 66,000 volts for one-quarter hour between cores and 40,000 volts for one-quarter hour between cores and lead.
5. Bending test was made on a percentage of the drums with a 3-yd. sample of cable bent three times in each direction to a radius equal to ten times the diameter of the cable. No sample so tested broke down at less than 120,000 volts between cores or 80,000 volts between cores and lead.
6. A dielectric loss test was made at voltages up to 50 per cent above working voltage in all cases.



A SECTION OF THE THREE-CORE, 33,000-VOLT CABLE READY FOR JOINING

When the cable had reached the finished stage further tests, including tests for insulation resistance, inductive capacity, copper resistance, pressure and dielectric loss, were taken as a check. In addition to the above tests, samples of the cable were subjected to the following special pressure tests:

1. This sample was tested by applying and gradually raising the potential between two cores until the testing ends flashed over. The voltage at which this occurred was 192,000. A similar test was made between cores and sheath, which withstood a voltage of 120,000 without breaking down the cable.
2. It was then desired to find out what would happen to this cable if it were run at a considerably higher voltage for a long period of time. To this end a length was taken and subjected to a three-phase potential of 100,000 volts between cores for a period of six hours. At the end of this time, although the cable had not broken down, the test was stopped and the cable dissected so that the paper on the conductors and fillings could be examined. It was found, as expected, that in some places the paper was very slightly carbonized.
3. A further test by taking a sample of the cable and subjecting it to a three-phase pressure of 60,000 volts between cores was then decided on. This voltage was maintained for twenty-four hours continuously. At the end of this time the cable was again opened, and it was found that absolutely no carbonizing of paper, either in the insulation of the cores or in the fillings, had taken place.

This data was submitted through the courtesy of the General Electric Company, Ltd., Kingsway, England.

Extracts from an Operating Code*

Charging and Maintaining Lightning Arresters

INSTRUCTIONS for charging, cleaning and inspecting electrolytic lightning arresters are given below. Frequent charging of arresters is necessary as the films on the surface of the trays are gradually dissolved by the electrolyte. Owing to the symmetrical connection of the line tanks between phases, no currents flow in the ground tanks when the charging switch is closed. To charge the ground tank it must be interchanged by means of a transfer switch with one of the line tanks.

Charging

1. Charge lightning arresters regularly every day at the time specified by the load dispatcher for each station.
2. To charge the arrester bridge the horn gap for a period of five seconds, repeating this operation two or three times at intervals of five seconds. Make sure that each gap bridge makes positive contact when closed and opens cleanly when released. Proper opening of the gap is particularly essential as overheating and probable explosion of the arrester will result from leaving it connected to the line.
3. Make and break the contact between the horns and bridging device quickly so that arcing will be reduced to a minimum.
4. To charge the ground tank of the arrester reverse the transfer device and repeat the operation of charging as previously described.
5. While chargihg arresters observe the arc which is formed between the horns, because the size and character of the arc are indications of the condition of the arrester. A heavy reddish arc indicates incomplete forming of the film, while a small spark indicates an open circuit in the arrester, due possibly to an insufficient quantity of electrolyte between the plates. When the arrester is in good condition a bluish crackling arc, which does not rise on the horns, will be formed when the gap is bridged.
6. Measure the charging current once per month, unless local conditions make more frequent checking desirable.
7. If the arrester is in good condition the charging current will vary from 0.30 amp. to 0.60 amp. A smaller current indicates an open circuit, a larger one a deteriorated film.

Cleaning and Inspection

1. Exercise extreme care when working around lightning arresters.
2. See that the ground connection to the supporting framework is not disturbed. This rule is particularly important both for the operation of the arrester in discharging excess voltages and for the personal safety of those working near the arrester.
3. Clean the tanks, supporting ironwork, horn gaps and contacts once every three or four weeks.
4. At this time make a thorough inspection of the arrester for adjustment of the horn gap, loose connections and poor contact surfaces, making such adjustments as necessary.

*Abstracted from the operating code of the Philadelphia Electric Company.

Instructions for Operating Circulating Pumps

IN ORDER to function, a centrifugal pump must be filled with water and when starting must constantly be primed. For this purpose a steam siphon is generally installed in the housing of the pump, which, by ejecting air, creates a vacuum lifting water to the pump. The discharge valve must be closed to establish this vacuum. The pump being started after priming, water will continue to flow to the condenser when the discharge is opened. When the condenser is full the water discharged through the tail pipe creates a siphon effect which aids the pump in maintaining the circulation of water through the condenser. Instructions for starting and shutting down circulating pumps follow.

Starting

1. Inspect the condenser for open doors and see that the vent on the tail pipe is open.
2. See that the condenser wash-out valve in the water box is closed.

3. See that the discharge valve is closed.
4. Admit water to the seals of the pump.
5. Prime the pump. (a) Use air ejector by opening the steam valve first and the air valve last to raise vacuum on the pump to lift the water. (b) Open the valve on the priming line between the tail pipe and the pump casing. This can be used only when another pump is in operation.
6. After the pump is filled with water, start the pump slowly.
7. See that the oil system is operating in bearings, coolers, etc., and that water is on the coolers.
8. Run the pump at a speed that will maintain 8 lb. to 10 lb. pressure on the pump.
9. Open the discharge valve a few turns until water appears or suction occurs at the vent on the tail pipe.
10. Close the tail pipe vent and open the discharge valve wide and bring the pump up to normal speed.
11. Shut down the air ejector, closing the air valve first and then the steam valve.

Shutting Down

1. Close the discharge valve.
2. Stop the pump.
3. Shut off the water from the seals.
4. Shut off the water from the oil cooler.

Portable Relay Testing Set

BY A. F. PALMER
Relay Inspector Puget Sound Power & Light Company, Seattle, Wash.

FOR convenience and facility in testing relays the Puget Sound Power & Light Company built a portable testing box which can handle a current capacity up to 67 amp. This apparatus has now been in use for more than two years and is so compact and rugged that the speed of testing has been increased considerably. The equipment consists of two load banks, both being of the same dimensions, 7 in. x 9 in. x 16 in.

The frame was constructed of No. 18 gage galvanized iron which was bent in small angle forms ¾ in. x ¾ in., then riveted together and soldered. Ward Leonard resistance units were placed in these frames in an upright position to lessen the chance of breakage, the units being held in place by small channel irons made of the same material as the frame. The bottom supports were riveted to the frame, while the top supports were fastened with screws in order that the resistances may be readily changed if broken or burned out.

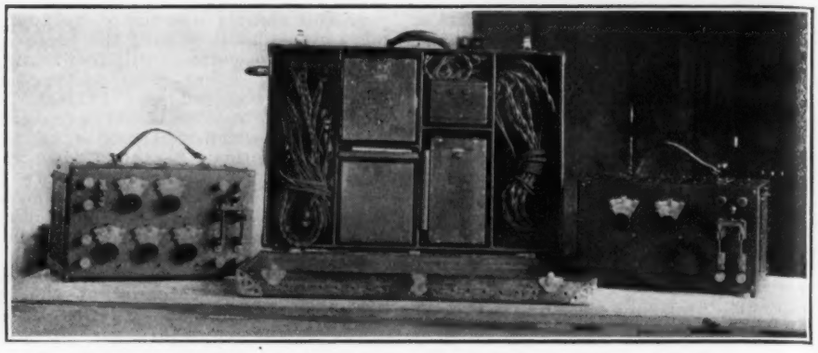


FIG. 2—THE WIRING DIAGRAM OF THE RELAY TESTING LOAD BANK

The panel for the switches was made of ⅜-in. transite board painted a flat black on the outside. This provides a panel which is not affected by heat from the resistances. Current-selecting switches are a three-contact multiple type designed to give a quick adjustment of current. Referring to Fig. 1, the bank at the left has a capacity of 22 amp. and will give any current value from 0.15 amp. to the capacity of the bank in 0.15-amp. steps. This is the one most used. The connections for this bank are shown in detail in Fig. 2. The bank at the right is of 45 amp. capacity and is to be used in parallel with the 22-amp. bank when a greater current value is needed. Three of the current steps on this bank are rated at 10 amp. and three at 5 amp. The type of resistance used in these banks gives a current value that is practically constant, not being affected by temperature changes. There is less than 1 amp. variation with both banks combined.

The instrument-carrying case is of fiber reinforced with three-ply veneering. The two outside compartments are for test cords and tools. The other compartments are for the following instruments: Alternating-current ammeter, single-phase power-factor meter, cycle counter and a portable auxiliary direct-current relay. The single-phase power-factor meter is used in selecting potential leads that are 30 deg. toward the lead direction with reference to current applied in reverse-power relays. This is to take care more perfectly of phase distortions produced by short circuits.

The cycle counter is used in place of a stop watch and indicates definitely the number of cycles which elapse between the time the relay receives current and the time the contacts are closed. The portable auxiliary relay is used in connection with the cycle counter in determining many combinations of time value, such as the time for contacts of the oil circuit breaker to open after the relay has received current or the time required for the current breaker to operate after relay has closed contacts. These time-lag values are very important on large systems.

In A and B of Fig. 1 are shown the connections used for testing the ordinary circuit-closing and circuit-opening type of relays.

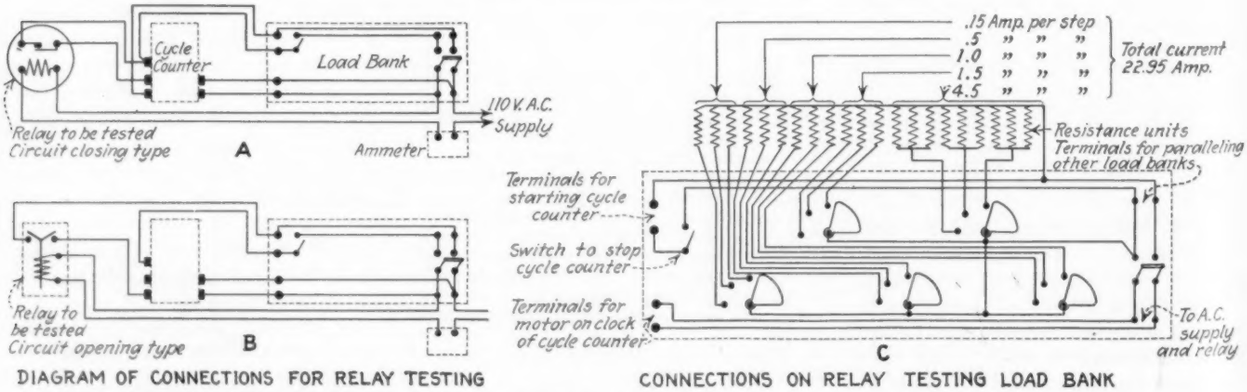

Cycle Counter
Load Bank
110 V. A.C. Supply
Relay to be tested Circuit closing type
A
Ammeter
Relay to be tested Circuit opening type
B
DIAGRAM OF CONNECTIONS FOR RELAY TESTING
.15 Amp. per step
.5 " " "
1.0 " " "
1.5 " " "
4.5 " " "
Total current 22.95 Amp.
Resistance units
Terminals for paralleling other load banks
Terminals for starting cycle counter
Switch to stop cycle counter
Terminals for motor on clock of cycle counter
To A.C. supply and relay
C
CONNECTIONS ON RELAY TESTING LOAD BANK

FIG. 1—THIS THREE-BOX RELAY-TESTING APPARATUS PROVIDES CAPACITY FOR CHECKING 67 AMP. OF LOAD

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

The Utility's Part in Business Building

Constructive Central Station Policy Results in Bringing New Industry to State—How the Company Benefits

THAT whatever builds up the surrounding territory also builds the utility and increases its prospective business assets is the belief of the Texas Power & Light Company. Accordingly, it has adopted the policy of energetically getting back of the promotion of any business projects that seem logical in the development of Texas. The way in which this policy is carried out is strikingly illustrated by the work of John W. Carpenter, vice-president and general manager of the company in the development of textile mills in Texas during the past year.

The theory that such mills could logically be located in Texas was based on the fact that the state produces one-third of the cotton crop of the United States. Incidentally, about one-tenth of this crop is grown within reach of the 1,000 miles of transmission lines and the plants of the Texas Power & Light Company. Cotton is therefore an asset to Texas that overshadows every other line of industrial or agricultural activity. The cotton gin has been an important source of energy sales and so thoroughly are the cotton ginners sold on the use of electric power that almost every gin within the reach of distribution lines is motor-driven. The one branch of the industry lacking was the manufacture of cotton into fabrics.

It had been tacitly assumed that there were reasons why the raw cotton should be shipped to distant points for the manufacture of fabrics. It was observed that in the southeastern section of the United States successful efforts toward the establishment of such mills in the heart of cotton growing territory were being made so that this section was becoming prominent in the manufacture of cotton fabrics.

To determine whether such manufacture is practical in Texas, Mr. Carpenter proceeded to inform himself on the textile manufacturing situation, first taking up a study of the trade periodicals and then establishing contact with the largest manufacturers. This was done by correspondence and by personal visits to Eastern mills, where conferences were had with the foremost authorities in the field. Becoming satisfied that the project was feasible, the next step was to convince both cotton textile manufacturers and the people of Texas that their state was the logical location for a textile manufacturing center.

To reach the people of Texas two things have been done. The first was to send copies of textile trade papers to selected lists of men in position to help the development of the manufacturing business. This was done to familiarize these men with the textile manufacturing business. In these magazines the Texas Power & Light Company had displayed its faith by advertising Texas as the logical location for cotton mills. Of course the merits of the company as a source of power supply were not forgotten. The second step was to bring prominent cotton mill men to Texas for visits of investigation to the various sections where textile manufacture might be advantageous. In this move two excursions have so far been arranged. One was early in February and the second the latter part of May of this year.

Texas Builders

Texas' 5,000,000 souls are working with the artisan of builders' tools to build within its borders great industrial institutions, and just at this time a great deal of work and money is being put into the cotton manufacturing industry.

Every man—carpenter, bricklayer, engineer, farmer, business man and industrial head—must join hands in the fight Texas is making to elevate the Lone Star State into the ranks of leadership in the cotton manufacturing industry. It means more building, more business, more and happier people and larger bank receipts.

Texas grows one-third of the cotton of the United States, yet there are only a score mills in the state. Texas must develop its natural resources. Cotton manufacturing is its greatest opportunity.

TEXAS POWER & LIGHT COMPANY.

ADVERTISEMENT SHOWING INDUSTRIAL ADVANTAGES OF TERRITORY

The parties were made up of textile men from the eastern part of the United States and business men of Texas interested in the development of the state. Meetings were arranged in numerous towns in the cotton-raising sections of the state through local commercial and other clubs and the proposition sold in this way to both the textile manufacturers and the Texas people.

Already a cotton mill for Dallas has materialized and is under construction. Another result has been the appropriation of $1,000,000 for the establishment of a new technical school in Texas, where the development of men for the textile industry will be undertaken.

WHAT THE WORK SUGGESTS

The results gained thus far indicate what such a policy means to a utility in added business and prestige in the community. In this case the Texas Power & Light Company has been a leader in a movement that was not confined to the territory served by the company, but was carried out to the benefit of other interests as well. Several of the railroads supplied excursion trains to carry the inspection parties into their territory. Men prominent in the textile world have been brought into the state and after investigation have passed favorably on the establishment of a textile industry in Texas. Mr. Carpenter, as the general manager of the Texas Power & Light Company, has traveled with these parties and was the leading speaker before the various civic bodies in the state. The movement has received many columns of publicity in the papers of the state. In all the publicity and in the minds of those who have

listened to the addresses the name of the company has been indelibly connected with the movement as an institution that has been willing to go out of its way to help the development of the state and take its chances of reward in the development that comes in the future, for, needless to say, the immediate returns in the form of power business are not expected to pay the time and expense put into the work.

"Electrified Ohio" a Feature Film

NO MATTER how familiar one may be with the central-station industry, the motion picture "Electrified Ohio," just completed for the Ohio Power Company by Pathescope, will be a revelation as to the possibilities of screening the operation of a large power system. At a private showing of this film in New York the audience, made up largely of central-station and holding-company executives, was held silent with interest as it watched the unfolding of this practical romance of the industry.

To those not connected with a utility company this film visualizes many undreamed-of uses for power. It shows vividly the steps in the generation and transmission of electrical energy. Beginning with scenes in the coal mine adjacent to the company's Windsor plant on the Ohio River, the film shows the progress of the coal out of the mine, through the tipple, over belt conveyors and into the boiler room, with some remarkable views taken inside the plant itself. From the outdoor switches the picture conveys its audience by means of an animated map over the transmission lines through Steubenville, East Liverpool, up to Canton and so on through the company's territory to the northwest corner of the state. Applications of power in different cities are strikingly illustrated. Unusual and spectacular operations of industrial machinery driven electrically are effectively illustrated in the manufacture of high-tension insulators, roller bearings, glass bottles, golf clubs, steel rails and a number of other products. The growth of the Ohio Power Company in customers and connected load is also shown by animated charts.

While this picture was being made a great deal of interest was aroused throughout the state. Newspapers recorded the progress of the work and the film has already received a considerable amount of publicity, as may be judged from the newspaper clippings shown here.

The picture itself is exceptional. It portrays truthfully the activities that go on behind the scenes in the operation of a large interconnected power system, and at the same time the atmosphere of propaganda has been kept at a minimum. Little attempt has been made to use employees in the capacity of actors. The whole story is carried by the physical operation of the company's equipment and the utilization of energy by industrial plants. The Ohio Power Company is to be congratulated on producing this picture.

CANTON, OHIO, WEDNESDAY, MAY 16, 1923.

MOTION PICTURE PARTY ARRIVES TO FILM CANTON INDUSTRIES

Will "Shoot" Scenes Of Nationally Known Local Manufacturing Plants For Ohio Power Co. Educational Series—To Be Here Several Days.

This morning there arrived in Canton the Pathescope filming party which is making the big educational motion picture for the Ohio Power Company. They have been for the past week "shooting" the tremendous Power Station at Windsor on the banks of the Ohio river below Steubenville from which Canton's electric power comes.

Scenes were made way back in the interior of the company's own coal mine of the miners and of the ingenious machines, run by electricity, which are used for cutting the coal out, of the loading of the mine cars and the tipple. The big chambers of the mine were made brighter than day by the flood of light from the great carbon arcs such as they use in the movie studios. They struggled up the steep hills back of the plant with their cameras and tripod to get a panorama or "long shot" of the mine mouth and the enormous structural iron bridge which supports the miles of rubber conveyor belting as it carries the coal directly from the tipple to the top of the plant from whence it flows to the massive battery of boilers.

Filmed Pottery Works.

The filming party spent several days in East Liverpool, Ohio, the pottery center of the world, and while there they took scenes of the application of electric power to the crockery industry. The grinding of clay and the moulding and shaping of the pieces before they are fired, are all done by electric power.

But the most spectacular picture of all was made in the plant of H. Thomas and Sons, where the big porcelain insulators for high tension transmission lines are made. Each insulator must be carefully tested before it can be sent out, so in a great vaulted windowless chamber, surrounded by transformers, coils and all sorts of testing apparatus they hung a series of some of the largest insulators made. Then they turned on the power! As more and more power was turned on, the insulators began to snap and crackle and finally at 350,000 volts, with a bang and a crash flashes of lightning filled the room.

The filming party will remain in Canton for some few days, making scenes in such nationally known plants as Timken, Hoover and United Alloy Steel. Canton, being famous as the home of diversified industry, gives them a peculiarly favorable opportunity to show to what widely different uses electric power is put. In this one city they can get scenes of the greatest variety of industries, perhaps more than in any other community in the United States.

Scenes Effectively Used.

The film when completed will be a permanent record of the achievements of Ohio manufacturers and will visualize for all of us the importance of electricity in our daily lives.

Canton will be among the first cities to see the finished picture before the company sends it through Ohio and the rest of the country.

NEWSPAPERS SHOWED UNUSUAL INTEREST IN THE FILMING OF "ELECTRIFIED OHIO"

NEWARK ADVOCATE

NEWARK, OHIO, FRIDAY EVENING, MAY 18, 1923.

USES OF ELECTRIC POWER TO BE SHOWN IN MOTION PICTURE

Ohio Power Company To Produce Film Showing System In Canton District And Its Application In The Large Industries.

Beginning this month a motion picture film will be made under the auspices of the Ohio Power Company to show to the people the wide diversification of industry in Ohio and the tremendous development and variety of the application of electric power.

As industry progresses and new methods for speeding up production are discovered, we become more and more dependent upon electric power. It is almost unbelievable to say that the industrial strength of a community is measured by the efficiency of its public utility service. By its aid one man can do as much today as two men years ago. All this will be shown vividly in the film and in addition, we will be taken into some of the largest industrial plants in Ohio and shown how electric power is used in the manufacture of widely different things.

We will follow the growth of this great Ohio Power Company in which thousands of us are stockholders and partners, from its comparatively small beginning years ago to its present great size as it has kept pace with our constantly increasing imperative demands for more and more power.

To serve us millions and millions of dollars have been invested in the somewhat mysterious equipment which is needed to make electricity. Thousands of workmen are employed to keep the system in repair, to build the always necessary additions, to make it possible for us to push a button any time of the day or night to light our lamps or run our vacuum cleaner or use our electric cranes.

Electricity can not be stored in a warehouse; you can not make it today and use it tomorrow—it must be made and used the same minute. This means that the Company must always have a great reserve of equipment ready for what they call the "peak load"; this peak may only come once a day or once a month, but when it comes, it must be met! The Company must be ready, must have the equipment to take care of it.

We will be shown the monster power house located right at the mouth of the company's own mine where they are assured of a constant supply of coal, where they generate power in the most economical and efficient manner. We can see that electricity is just another form of energy—another form of coal. It is easier and more economical to use the great transmission lines to bring this power to us than it is to bring the coal in cars on the railroads. By burning the coal at the mine the Company releases for other uses thousands or rather hundreds of thousand of coal cars.

A well known motion picture company specializing in Educational Films will enter the various factories that have been selected as representative scenes of Ohio's industries. The trained eye of the director will select those scenes illustrating the spectacular and interesting uses of power. The whole will be welded together into a fascinating record of the industrial achievements of the State.

The Company wants to show us that it is a great, big human organization, operated by our friends and neighbors, working and striving to serve us in every way—showing its high faith in the magnificent prospect of Ohio's future by investing millions in additional plants and equipment. The Company deserves the support of all its stockholders and customers, and of all well wishers of the community in this great educational campaign to show us by motion pictures how dependent we are in our daily lives for our comforts and necessities upon electricity and how nobly they are striving to meet our every need.

To Attract New and Please Old Customers

TO KEEP established customers contented and pleased with central-station service as well as to attract new patrons is the aim of the accompanying advertisement used in a house-wiring campaign now being

This simple plug takes the place of Stove, Fuel, Matches, Labor
Just push the plug into the convenience outlet—in a jiffy, you're all ready to iron.
This is but one of the numberless labor-saving, time-saving, health-saving, comfort-bringing advantages of an electrified home.
Give your family these conveniences. Make your home a home—a place of comfort, ease, enjoyment.
You can afford it. We will wire your home—connections, switches, lighting fixtures, all complete—for $2 down and 2 years to pay balance. Let's tell you more about our plan. Just 'phone us.
Telephone 123
Haverhill Electric Co.

SHOW SIMPLICITY OF USING ELECTRICAL CONVENIENCES

run by the Haverhill (Mass.) Electric Company. By emphasizing the advantages of electricity in the home pictorially along with the easy terms by which service can be secured the company effectively appeals to local residents.

"Tell the Public"

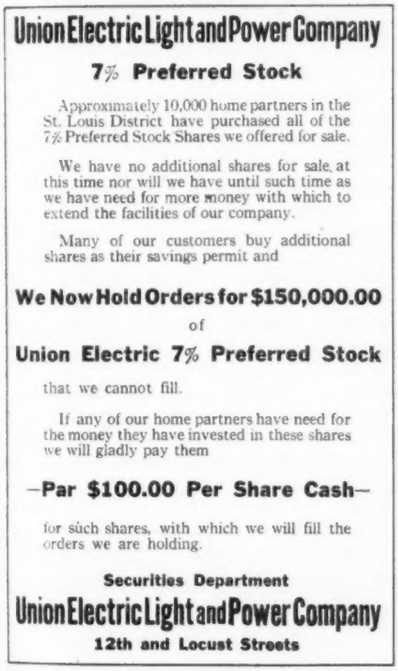
WITH the above caption as its slogan the Alabama Power Company is now publishing a series of advertisements in the newspapers of Alabama, setting forth as clearly and concisely as possible facts relating to the operation of the company and showing how they affect the individual citizens of the state.

The advertisement says:

"With full realization of its threefold responsibility: First, to the people of Alabama; second, to its employees; third, to its stock and bond holders; it is the policy of the Alabama Power Company to create a closer relationship between its organization and the public which it serves; to promote and foster a better understanding of its activities and their effects upon the economic and industrial life of Alabama; and to develop a more pronounced spirit of co-operation in the upbuilding of our state."

Demand for Utility's Stock Greater than Supply

THE Union Electric Light & Power Company of St. Louis has sold, through its securities department and employees, 7 per cent preferred stock to the extent of $9,000,000, which composes the total amount of preferred stock that has been authorized for sale up to the present time. This stock has been sold during a period of about six years and was purchased by approximately ten thousand customers and friends of the company. Many preferred stock holders have formed the habit of buying additional shares of preferred stock as they accumulate sufficient funds to do so. At the present time applications which cannot


Union Electric Light and Power Company
7% Preferred Stock
Approximately 10,000 home partners in the St. Louis District have purchased all of the 7% Preferred Stock Shares we offered for sale.
We have no additional shares for sale at this time nor will we have until such time as we have need for more money with which to extend the facilities of our company.
Many of our customers buy additional shares as their savings permit and
We Now Hold Orders for $150,000.00
of
Union Electric 7% Preferred Stock
that we cannot fill.
If any of our home partners have need for the money they have invested in these shares we will gladly pay them
—Par $100.00 Per Share Cash—
for such shares, with which we will fill the orders we are holding.
Securities Department
Union Electric Light and Power Company
12th and Locust Streets

EVIDENCE OF THE DEMAND FOR UTILITY'S STOCK AS AN INVESTMENT

be filled are on file for the company's 7 per cent preferred stock to the extent of $150,000. To try to obtain small blocks of stock for such customers the company ran the accompanying advertisement in recent issues of the St. Louis papers.

Boston Edison Issues Book of Home Comforts

TO GIVE the non-electrical home occupant an idea in simple language of the principal points to bear in mind in planning for wiring, the Edison Electric Illuminating Company of Boston has recently issued an attractive ten-page booklet which is far removed from the usual "Rules and Regulations on Electric Wiring" —so dry and technical to the public —which central station companies put in the hands of new customers, contractor-dealers and architects. The booklet was prepared by L. D. Gibbs, superintendent of the company's advertising department, in connection with a newspaper symposium on better homes. It is a republished article on "Complete Electric Comfort in Your Home," which was well received during the Boston *Herald s* campaign for better housing. The original article covers wiring outlets and appropriate symbols, but in the booklet only a friendly statement of the things to consider in planning wiring service is included.

What Other Companies Are Doing

Oil City, Pa.—The wiring campaign which has been carried on by the Citizens' Light & Power Company has resulted in the closing of an average of forty-eight contracts per month. At the outset of the campaign the company agreed to assume the responsibility for obtaining the contracts and for financing the activity, and the business resulting has been satisfactory both to the contractors and to the central station. The electrical contractors in the territory served by the utility gave their whole-hearted co-operation, and events have proved that they are handling the contracts at a reasonable profit and at the same time have been wiring homes that would not otherwise have been secured.

Pawtucket, R. I.—In a recent customer and employee ownership campaign, the Blackstone Valley Gas & Electric Company sold 3,482 shares of stock to 694 purchasers, of whom 489 were customers taking 2,835 shares. Although the sale included both cash and time-payment plans, 271 purchasers bought outright 1,688 shares, and the number of customers who paid cash totaled 244 against 245 on the partial-payment plan, showing local recognition of the value of this public utility security as a means of investing accumulated savings.

Philadelphia, Pa.—The electrical interests of this city are preparing for an electrical home exhibition to be held, probably, in October. It is planned to have two houses for the exhibition, a new house and an old one renovated. The Philadelphia Electric Company has subscribed $5,000 for the enterprise, the jobbers have contributed $2,500, the Electric Club $750, and the fixture interests $2,000. The contractors are expected to contribute about $2,000. The new exhibit house will be in the Lincoln Drive section of the city, and the other will probably be in the northeastern part.

Denver, Col.—In connection with the Denver Gas & Electric Light Company, the industrial development committee of the Civic and Commercial Association of Denver has begun a study which has for its object the devising of the best methods to utilize electric power for the development of manufacturing in the city. At a recent meeting discussion centered around the readiness-to-serve rule of the power company. It was stated that this rule was not entirely understood by the majority of manufacturers. V. L. Board, representative of the Denver Gas & Electric Light Company, stated that the company was ready to co-operate with the manufacturers in every way for the industrial development of the city. The decision reached was to hold a meeting with a special representative of the Doherty interests who will visit Denver in the near future. This representative is endeavoring to increase the commercial and industrial use of power.

California.—The East Bay headquarters for the Pacific Gas & Electric Company in Oakland was officially dedicated recently. At that time the late John A. Britton placed a copper box of relics behind the cornerstone of the building and put in the first trowelful of mortar that was to hold the cornerstone. Following this ceremony dedication ceremonies were held in the assembly hall of the building. The cost of this eight-story building was about $350,000. The main offices, where customers are cared for, are on the first floor. A display room for appliances is maintained in the basement. Offices of various departments are on the floors between the first and seventh. The load dispatcher's department is on the seventh floor. All the service lines in the northern part of the state are controlled here from the load dispatcher's board. Special telephone wires give the dispatcher ready communication with all generating plants.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

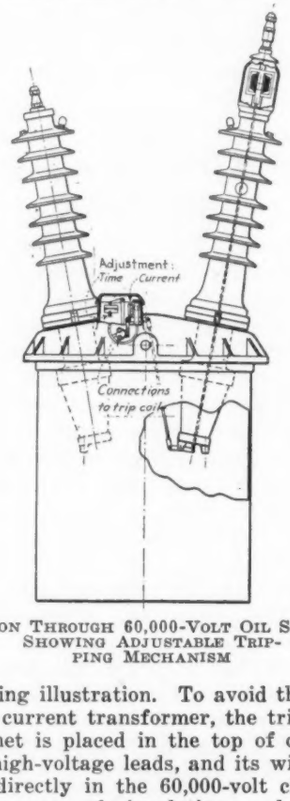
Interpretation of Surface-Condenser Readings.—B. C. SPRAGUE.—The large number of variable factors affecting the heat transfer in surface condensers makes the determination of the condition of the tube surfaces from condenser readings very difficult. In this article the author gives an idea of the readings obtainable and their significance. Among these readings should be the weight of steam condensed per unit of time, the inlet circulating-water temperature, the amount of air leakage, the volume of gases removed by the air pump or ejectors, the volume and velocity of the circulating water and the amount of deposited solids on the tube surfaces.—*Power*, July 10, 1923.

The Portobello Power Station in Scotland.—This new Edinburgh power station, on the Firth of Forth, has a present capacity of 30,000 kw. with possible extensions for 100,000 kw. Besides a general description of the boiler room, turbine room, switch house, coal-conveying arrangements, etc., there is an interesting account of three water tunnels for supplying the condensing water. Shafts for the tunnels were sunk at the station, from the bottom of which the three tunnels were carried one-third of a mile out to meet other shafts sunk in the sea bed. This tunneling was done after the manner of the London tube railways, lined with cast-iron segments and smoothed off with concrete. On each of the three sea shafts is a beacon and a winch.—*Electrical Times* (*England*), July 12, 1923.

Tests of Five Models of Draft Tubes for Turbines.—A series of tests are recorded that were made with a turbine and tubes geometrically similar to full-sized ones. It was shown that the new symmetrical types were superior to older forms. The draft tubes of the turbine must be designed to take care of a complex condition of flow. Each installation requires special treatment and study.—*Engineering News-Record*, Aug. 2, 1923.

Transmission, Substations and Distribution

Substation of the Chemins de Fer du Midi.—H. RAEMY.—This outdoor-type substation is one of the fourteen which have been installed lately for the electrification of the Dax-Toulouse branch, operated with 1,500-volt direct current. The station contains three 750-kw., three-phase transformers of the self-cooled oil-conservator type, which reduce the incoming 60,000 volts to 1,150 volts. Three six-phase rotaries rectify the current to the overhead voltage of 1,500. The 60,000-volt oil switches, with a tested rupturing capacity of 300,000 kva., are composed of single-pole units, each in a round tank, holding 800 liters of oil. They are remotely controlled with a closing and a tripping magnet. Closing one three-phase switch set requires 7 kw. direct current for four-tenths of a second. Of particular interest is the overload tripping mechanism shown in the accompanying illustration. To avoid the use of a current transformer, the tripping magnet is placed in the top of one of the high-voltage leads, and its winding lies directly in the 60,000-volt circuit. By means of insulating rods and levers the motion of the magnet armature is transmitted down into the oil tank and out of it again to the regulating device which gives an independent current and time adjustment. Any change of the setting may be made safely while the switch is alive. Auxiliary contacts with interposed resistance avoid a current rush in closing the switch. Oscillographic investigations have shown that in closing the switch with the remote-control magnet the protective resistance of the first contact remains in series with the line for, on the average, five cycles on a 50-cycle system. All iron parts of the switch are zinc-coated by the Schoop process to avoid rusting. To prevent a dangerous glow discharge between the top metal cap and the upper part of the porcelain bushing, a zinc coat is sprayed over this junction, extending over the entire upper surface of the uppermost porcelain petticoat.—*Revue Générale de l'Electricité*, July 14, 1923.



SECTION THROUGH 60,000-VOLT OIL SWITCH, SHOWING ADJUSTABLE TRIPPING MECHANISM

Spacing and Wire Stresses of Catenary Supporting Structures.—P. A. MCGEE.—The subject is considered with particular reference to wind-load effects. The effect of temperature, wind and ice is shown in typical curves for single catenary systems having 150-ft. and 300-ft. spans respectively. A complete analysis is made of typical catenary construction.—*Electric Journal*, July, 1923.

Generation, Control, Switching and Protection

Grounding Reactors.—A symposium of four papers on the various types of grounding reactors now in use. The first paper, by Y. Watanabe, considers the resonance in a circuit that includes a condenser and an iron-core inductance, with particular reference to the Petersen coil. This paper includes remarks on the mathematical methods explaining the resonance, a general equation and graphical method of explaining the jumping phenomena and experimental results of various tests conducted. In the second paper by the same author a method is proposed for grounding the neutral transmission system, using a condenser in conjunction with a grounding reactor. The advantage of this method lies in the fact that a reactor with a slightly saturated core may be safely employed so as to compensate exactly for the capacity current without causing any appreciable wave distortion, so that the quenching action is very effective. In the third paper S. Togo considers the design of resonance factors and discusses the equilibrium points in resonance elementary reactors and the protection against series resonance. In the fourth paper, by H. Yagi, problems of grounding resonant coils are considered.—*Journal of Institute of Electrical Engineers of Japan*, July, 1923.

Units, Measurements and Instruments

Efficiency Tests Made on 55,000-Hp. Hydro-Electric Units.—H. G. ACRES.—This paper, presented before the A. S. M. E. spring meeting at Montreal, shows that between 32,000 hp. and 63,000 hp. an efficiency of 90 per cent and over was obtained for the turbine, with a maximum efficiency of 93.5 per cent. A maximum over-all efficiency of 91 per cent was developed for the complete unit. The Gibson method of measuring the flow is described and the pressure-time diagrams are analyzed.—*Power*, July 24, 1923.

Rail-Joint Tests on the Detroit Municipal Railway.—The Municipal Department of Street Railways in Detroit has conducted an extended series of tests on seam-welded rail joints. Full particulars are given, with comments on a large number of cast-welded joints removed during track rehabilitation. Summarizing, the tests indicate that the cast-welding process,

besides being more inconvenient to apply, is less reliable for rail joints than the seam-welding process. Moreover, the method of construction with seam-welded joints used in Detroit is effective both mechanically and electrically. The tests show that further study of the metallurgy of electrically welded rail joints is desirable.—*Electric Railway Journal*, July 21, 1923.

Illumination

Lighting of Theaters and Auditoriums.—A. L. POWELL.—The author considers the location, size and type of the unit, intensity of illumination and the proper decorative effect of this kind of illumination. The following parts of theaters and auditoriums are considered individually: Entrance, foyer, lounge, theater auditorium, motion-picture auditorium, concert hall, assembly room, lodge room and building exterior. The relation between light and music is also discussed.—*Bulletin L.D. 145 of the Edison Lamp Works.*

Esthetic and Utilitarian Value of Luminaires.—E. G. PERROT.—In the designing of luminaires the illuminating engineer should have a knowledge of the architectural styles and periods, so that the method of lighting will be in harmony with the style of the room or building. While there are certain problems, such as the lighting of offices or factories, in which the object of the light provided is purely utilitarian, and where the illuminating engineer has much good work to do in providing efficient and serviceable conditions of illumination, there are higher fields for his activity in connection with the lighting of buildings of distinction, where esthetic and architectural considerations must prevail.—*Transactions of I. E. S.*, July, 1923.

Motors and Control

Explosion-Proof Electric Motors.—E. J. GLEIM.—The explosibility of methane air and gasoline air mixtures as related to the design of explosion-proof electric motors is considered. A description of how the tests were conducted, effectiveness of different gauze combinations, cooling surface required to prevent an explosion, etc., are discussed. A general tabulation of the results and a discussion of the test results are also given.—*Serial No. 2,422, Bureau of Mines.*

Protection That Safety Switches Can Provide.—D. H. BRAYMER.—The elements of protection that insure safety in the manipulation of inclosed, externally operated switches at machines, their inspection, repair and maintenance, and the resulting economies from the standpoint of elimination of preventable accidents and interruptions of power service, are discussed. The requirements for protection from the standpoint of both user and manufacturer, giving the features of design and construction which are essential in order to insure the protection desired, are also considered.—*Industrial Engineer*, August, 1923.

Heat Appliances and Material Handling

Arc-Welded Cast-Iron Enameled Ware.—O. H. ESCHHOLZ.—The most frequent defects encountered in thin ⅛-in. to 1/16-in. cast-iron structures for enameled ware are small holes and weakening cracks. These may be repaired in most cases by employing the metallic electrode arc-welding process with either cast-iron or steel electrodes. The procedure for repairing is described.—*Journal of American Welding Society*, July, 1923.

Electric Welding Car.—C. L. BAXTER.—An electric welding car has been added to the standard welding equipment of the New Brunswick Power Company at St. John, N. B. The reason for mounting the equipment in a motor car is to provide a portable unit which would be suitable for track or shop use.—*Electric Railway Journal*, July 21, 1923.

Traction

Collecting 5,400 Amp. at 58 M.P.H.—In recent tests conducted at Erie, Pa., a new form of overhead trolley suspension was tried. With a pantograph collector large amounts of current are drawn without difficulty. The new type is a modification of the usual catenary construction of the so-called laced suspension type of construction.—*Electric Railway Journal*, July 28, 1923.

Electric Railway Construction and Operation in Cuba.—L. GEENENS.—The reasons for building the Hershey-Cuban Electric Railway and the construction methods employed are recounted. Some of the electrical difficulties caused by the moist, warm tropical climate and how they were overcome are discussed.—*Electric Railway Journal*, July 28, 1923.

Electrophysics, Electrochemistry and Batteries

Measurement of Permeability of Iron.—H. NUKIYAMA and Y. SHOJI.—Complex permeability is defined as the ratio of the effective value of the harmonics of alternating magnetic induction and magnetic force. The authors determine the complex permeability by measuring the impedance of the magnetizing coil arranged in the same manner as Epstein's apparatus when there is no iron core and when there is an iron core of the sample to be tested. The actual result obtained by this method in the audio-frequency range with sheet iron for telephone and amplifier use is compared with the static hysteresis loop obtained by the ordinary magnetometer method.—*Journal of Institute of Electrical Engineers of Japan*, June, 1923.

Specification for Dry Cells.—Specifications officially adopted by the Federal Specifications Board for the use of the departments and independent establishments of the government in the purchase of dry cells are given. These include definitions, types and sizes of cells, specifications of carton, zinc can, sealing compound, terminals and cell connections. Required voltage, various tests to show results obtained and performance characteristics are also included.—*Circular No. 139, Bureau of Standards.*

Comparison of Planté Type Secondary Batteries.—SAKAE MAKIO.—Comparison is made of the Planté type of secondary batteries that are principally used for communication work. Tests were made on batteries made in Japan, America, England and Germany. The experiments conducted reveal that, in spite of the fact that the comparison was carried out on the basis of equality of nominal capacities, their true capacities are not the same. A series of tables arranged in sequence gives the true capacities at various discharge rates of ten different batteries.—*Report of Electrotechnical Laboratory, Tokyo, Japan*, May, 1923.

Telegraphy, Telephony, Radio and Signals

Vacuum Tubes as Power Oscillators.—D. C. PRINCE.—An exact method is developed whereby the performance of a vacuum tube as an oscillation generator can be determined, together with the required voltages which must be impressed upon the different members to obtain such results. A method is developed whereby the effect of varying factors, such as space charge, voltage and so on, can be more readily determined than by the first method. Based on the conditions required for the tube, the design of a single tuned circuit is developed. The operation of vacuum tubes in doubly periodic circuits is described and the criterion for double periodicity is derived. Methods of controlling oscillations in this type of circuits are suggested. In the October issue the influence of the receiving circuit on the efficiency and output of the vacuum-tube power amplifier will be discussed, the methods outlined above being applied to circuits in which the plate voltages are not sinusoidal, and it will be shown that efficiencies and output may be considerably increased by circuit arrangements which give special wave form. A brief comparison will also be given showing the correspondence between theory and observation affecting emission, space charge and amplification constant.—*Proceedings of Institute of Radio Engineers*, June and August, 1923.

Tests of Radio Receiving Sets.—The results of tests of radio receiving sets by the Bureau of Standards are given in a series of Letter Circulars, of which the first (No. 90) deals with tests of electron tube sets. This circular gives the results of tests of crystal detector sets.—*Letter Circular No. 93, Bureau of Standards.*

Transatlantic Radio Telephony.—H. D. ARNOLD and LLOYD ESPENSCHIED.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, on page 21.—*Journal of A. I. E. E.*, August, 1923.

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

Elements of Radio Communication

By Ellery W. Stone. New York: D. Van Nostrand Company. Second edition. 318 pages, illustrated.

Few elementary books on radio have value even to the non-technical reader for whom they are written. In the process of simplification much is lost. They are usually filled with pages of obsolete apparatus and circuit diagrams which serve no useful purpose. Happily this book does not fall in the foregoing class. The author has, in this the second edition, presented fundamental principles in language easily understood by the beginner. At the same time he has introduced new material and suggestive ideas that will prove stimulating even to the more advanced student. The book contains much information which is not usually found in other elementary texts. H. M. TURNER.

L'Eclairage

By E. Darmois, professor at Nancy. Paris: Gauthier-Villars et Cie. 276 pages, illustrated.

This work is one of a series of volumes devoted to technical, economic and financial subjects affecting industry, and according to an elaboration of the title gives "modern solutions of the problems of industrial lighting." As stated in a preface by Prof. André Blondel, the author has written on the one hand for the purpose of fostering the spirit of research in the field of lighting and on the other hand to make known to the general public and in particular to those engaged in industry the rational and efficient use of light sources and luminous flux.

In France illuminating engineering, as we know it, is not such an active branch of the profession as it is in this country or Great Britain, and so knowledge of progress in this field is not so readily accessible. The author has included many quite recent developments, such as the work of the 1921 meeting of the International Committee on Illumination, the Fabry and Buisson universal photometer, the neon tube, factory and school lighting and codes.

The academic instincts of the author are evident in the mathematical treatment in the chapter on definitions and units. However, the development is logical, starting with luminous flux as the basic quantity, and is not difficult to follow if one is somewhat familiar with the infinitesimal calculus and notation. The chapter on photometry is a very good condensed statement, including a brief discussion of the Ulbright sphere and of the measurement of sources differing in color.

The second part of the book, devoted to light sources, is more or less conventional, but includes a chapter on the radiation from a standard radiator (black body) and possibilities in the way of more efficient sources. It seems rather unfortunate that in discussing the incandescent lamp the author has retained the use of the term "half-watt," which is a misnomer and has become obsolete in this country.

The third part of the book is on the physiology of light and the hygiene of lighting, while the fourth part takes up lighting installations, including good discussions of methods and calculations as well as descriptions and illustrations of specific cases. It is interesting to compare the table of illumination values, all given in lux, with those which are now being recommended in this country. The maximum value in the table is 200 lux (19.4 foot-candles) for the illumination of black goods in show windows. At the 1922 convention of the Illuminating Engineering Society values for show-window lighting as high as 100 foot-candles were discussed. For class-room lighting in schools the table gives 30 lux (2.9 foot-candles), as against 3.5 to 6 foot-candles recommended in the old Code of School Lighting of the Illuminating Engineering Society and 5 to 10 foot-candles to be recommended in the revised code.

On the whole, the book covers the subject of illumination very well, combines theoretical and practical knowledge in a useful way, and should fill a gap in French technical literature. For the benefit of American readers it should be said that the author's style is very straightforward and readable, and any one with only a smattering of knowledge of the French language should be able to understand the diction without difficulty. F. E. CADY.

The Electric Furnace for Iron and Steel

By Alfred Stansfield. New York: McGraw-Hill Book Company, Inc. 440 pages, illustrated. First edition.

Professor Stansfield in this book has attempted to give a reasonably complete account of the electric smelting of iron ores to make pig iron and the making of steel from metallic charges in electric furnaces. The first part of the book contains historical matter, outlines the fundamental principles of the metallurgy of iron and steel and gives a very brief description of the electrical supply system for electric furnaces. This part is followed by a description of the electric smelting of iron ores for pig iron, the reduction of iron ores in the state of powder for subsequent smelting in electric furnaces and the production of ferro-alloys in electric furnaces. The last part of the book deals with the production of iron and steel from metallic materials and the various types of electric furnaces in use for this purpose and includes a chapter on the production of steel from iron ore and on electric welding.

The book is replete with statistics on the production of iron and steel in electric furnaces in the different nations of the world, and it emphasizes strongly the metallurgical aspects of the industry. The chapter on electric supplies for furnaces is very brief and general in character and could have been improved by being more specific and quantitative in treatment. The book is particularly valuable for its splendid description of all types of electric furnaces now available and for economic and metallurgical data showing the performances of these furnaces in different localities. The illustrations and charts aid materially in giving an understanding of the contents. The book should prove very valuable to those directly connected with the business and interesting to all engineers who desire to get a general understanding and knowledge of development in electric furnace application and construction.

Power Plant Machinery

Vol. I. By W. H. James and M. W. Dole. 271 pages, illustrated. New York: John Wiley & Sons, Inc.

The steam engine from the kinematic standpoint is the chief topic treated in this elementary textbook, which has been revised by the authors. As planned it is the first volume of a series for treating of the machines used in power plants. It covers the kinematics and details of valves and valve gear on the ordinary types of steam engines and also deals with governors and turbine valve mechanisms. The indicator card and its interpretation serve to introduce some heat engineering theory into the text. Problems are inserted for applying the principles incorporated in the text. Much detailed material on valve mechanisms will be found in the book which should make it valuable to operating engineers and teachers.

Books Received

Handbuch der Elektrischen Raumheizung. By Wilhelm Heepke. Halle: Carl Marhold Verlagsbuchhandlung. 264 pages, illustrated.

Données Numériques d'Électricité, Magnétisme et Électrochimie. Paris: Gauthier-Villars et Cie. Extract from Volume IV, years 1913-1916. From page 627 to page 1016. Preface by Dr. F. B. Jewett.

Patents Throughout the World. By William Wallace White and Wallace White. New York: Trade Mark Law Publishing Company. 244 pages, with tables and maps.

Der Glimmschutz. By Dr. Georg I. Meyer. Leipzig and Berlin: B. G. Teubner. 61 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Americans Thought Safe

Cablegrams Allay Anxiety Concerning Many Manufacturing Representatives in Japan

ANXIETY concerning the safety of American electrical men in Japan in view of the terrible catastrophe in that country can now be in large degree allayed.

The General Electric Company has received a cablegram from that country saying that all its representatives are safe, although some were injured. With their families the General Electric men, who escaped in a boat from the scene of destruction, are now on their way back to the United States. The company had about fifteen Americans stationed in Yokohama and a smaller number in Tokio.

The Westinghouse company has received a cable from Shanghai saying that its Japanese representatives are safe. The company had about six men in Japan, four at Tokio and two being engineers engaged in installation work.

The Western Electric Company has been unable to get any direct word from its employees except a cablegram from Kobe relating to its comptroller, E. S. G. Elliott, and his family, who are safe. A newspaper dispatch published on Thursday said that W. T. Blume of the General Electric Company had been killed. Mr. Blume, however, was a Western Electric Company man. The Western Electric Company operated a factory in Tokio employing 1,200 operators with a staff of four Americans. One newspaper dispatch reported that this factory was destroyed and 600 people killed. A later dispatch states, however, that the district in which it was situated was practically undamaged. P. K. Condict, vice-president of the International Western Electric Company, was expected to arrive in Tokio on the day of the earthquake, and considerable anxiety is felt as to his safety.

John I. Beggs Tells Plans of Milwaukee Company

Announcement last week of a ten-million-dollar bond issue by the Milwaukee Electric Railway & Light Company means that the capacity of the huge Lakeside power plant at Cudahy is to be doubled, that additions and extensions are to be made to local and interurban electric railway lines and to the electric light and power distributing system of the company, which furnishes service to nearly all of the utilities in the southeastern section of the state, comprising an area of more than 4,000 square miles with a total population in excess of 850,000 people, and that other expenditures in the company's program are to be provided for, according to John I. Beggs, president of the company. In addition, $3,600,000 worth of 7 per cent five-year notes, due in November, are to be retired. The new issue will bear 6 per cent interest.

Colorado River Hearing

Federal Board Notifies J. B. Girand and State Governors to Be Represented Sept. 24

A HEARING which may be expected to bring out fully the conflicting views regarding power and irrigation rights along the Colorado River and which probably will have an important bearing on the pending compact among the states interested will be held Sept. 24 before the Federal Power Commission in Washington.

J. B. Girand, who holds a preliminary permit for development of a hydro-electric project on Diamond Creek, Ariz., recently wrote the commission asking that action be taken on his application for a license, which has been pending since March, 1922, or that he be permitted to present arguments in behalf of the application. A few days later the Governor of Arizona wrote the commission requesting a conference between that body and a committee of Arizona citizens on the Girand application and the Colorado River problem in general. In view of these requests, the commission has notified Mr. Girand to appear before the commission on Sept. 24, and the Governor of Arizona has been notified that a committee of citizens or officials from his state will be received on the same date. In order that all interests may be represented, the commission has also invited the Governors of Colorado, Wyoming, Utah, New Mexico, Nevada and California to send representatives to this hearing.

The Arizona state permit held by Mr. Girand will expire Dec. 31 by default if work is not started under its terms, and it is generally believed that, owing to a change in state administration, he would experience considerable difficulty in securing a renewal; but he cannot proceed under the state permit without a license from the Federal Power Commission, which has withheld action on his application for a year and a half awaiting the hoped-for compact among the states.

Pennsylvania Power Board

At First Meeting of New Body Governor Pinchot Outlines Principles of Procedure

THE first meeting of the board provided for in the water-power legislation passed by the Pennsylvania State Legislature at its last session, in accordance with Governor Pinchot's recommendations, was held on Aug. 28, at which time the board was organized for the purpose of determining the latent resources of the state. The board consists of the Governor, who is chairman; the Attorney-General, the State Secretary of Agriculture, the State Secretary of Labor and Industry, the State Geologist, Deputy Attorney-General Philip P. Wells, Chairman W. D. B. Ainey of the Public Service Commission and Dr. R. H. Fernwald, director of mechanical engineering at the University of Pennsylvania, who will act as power expert. The survey will be conducted by Morris L. Cook, who was Director of Public Works in Philadelphia under Mayor Blankenburg. He organized the power section of the Emergency Fleet Corporation during the war and frequently represented the government in power matters. He was a member of the advisory transit board of engineers in Philadelphia appointed by Mayor Moore, and recently at the request of Governor Pinchot he conducted a survey of public utility regulation in Pennsylvania.

Concern for Farmer

The meeting was opened by the Governor, who told the members that he wanted them to determine the best methods for utilizing hydro-electric power and the power it is hoped to obtain from coal ordinarily wasted at the mines. He called attention to the probable effect on the coal industry and declared that the development of giant power stations at the mines would stabilize employment. The by-products which are now wasted in burning raw coal would be recovered. He asserted that his plan will give the consumer energy at a much lower rate, which in turn will increase the distribution of power to the farms, factories and homes, and this in turn will increase the demand for coal. In the investigations to be conducted, the Governor said, the first concern would be for the small consumer and the farmer. Technically no system of electrical development could be sound without being built on estimates of the industrial power load; just so, no system could

be socially sound without considering the requirements of the two hundred thousand or more farmers and perhaps the same number of urban or semi-urban homes in the state.

The work will begin as soon as possible, and the survey of the Susquehanna River and its power possibilities will be one of the first steps to be taken.

Kansas Gas & Electric's New 60,000-Kva. Plant

Construction is being pushed on the Kansas Gas & Electric Company's new 60,000-kva. steam plant at Service City, on the Neosho River, about 12 miles southeast of Parsons. This plant is being built along the most modern lines and will feed a 132,000-volt steel-tower transmission line already completed from Service City to Midian, Kan., just east of El Dorado, a distance of 112 miles. The power house and transmission line together will cost $7,000,000.

The demand for electrical energy is pressing, according to officials of the Kansas Gas & Electric Company, which, with headquarters at Wichita, serves more than forty places in central and southeastern Kansas with light and power, and it is hoped that work on the new plant will be completed in November. R. J. Bassett, superintendent of the Phoenix Utility Company, is in charge of construction.

General Harbord Talks About World Radio Affairs

Just returned from a trip to Europe, where he attended a meeting of the consortium of American, British, French and German radio companies held in London, General James G. Harbord, president of the Radio Corporation of America, said that the chief object of the sessions was to complete plans for a projected radio communication service connecting both the United States and Europe directly with South America. Circuits will extend from the high power stations at St. Asise in France, Nauen in Germany and Carnavan in Wales direct to Buenos Aires, while others will bridge the gap between New York City and Buenos Aires through the intermediary of the Radio Corporation of America station on Long Island. Reception from France and the United States has already been established at Buenos Aires, and a high-power transmitting station is being erected there. It is expected that the new service will be ready for commercial use this fall.

When asked about the status of radio broadcasting across the seas, General Harbord had this to say: "During my visit in France I had the opportunity to manipulate a French broadcast receiver and listen in to a program broadcast from the Eiffel Tower. The complicated apparatus used for this reception was in striking contrast to the efficient receivers of simplified control that we have in this country at present."

Referring to the agreement between his company and the Chinese government, General Harbord said: "This undertaking calls for the erection of five powerful stations in China, the principal one at Shanghai. Shanghai will also operate a station of lesser power for communication with similar smaller stations at Pekin, Canton and Harbin, cities separated from one another by approximately 800 miles. These stations will be operated jointly by the Federal Telegraph Company of Delaware and the Chinese government, thus placing the project under Chinese-American administration. There are no exclusive or monopolistic features in this contract, and American business men will be quick to appreciate the commercial significance of the plan, inasmuch as there is today only one cable crossing the Pacific to China."

Work on the Chinese stations will begin this fall, and the inauguration of service is expected during the latter part of 1925, although the plan may reach maturity before that time. Test signals will span the Pacific from China well in advance of the official opening, however.

N. E. L. A. Men Report General Prosperity

Executive Committee Meetings at Headquarters Fully Attended—"National Service Survey" to Go Ahead—President's List of Committee Chairmen Ratified

BUDGETS for geographic division and national activities were discussed and approved at the meeting of the national executive committee of the National Electric Light Association held at headquarters in New York City on Friday, Aug. 31. Details of the program for the present administrative year were outlined, and the program was unanimously adopted at this meeting and at a meeting of the Public Relations National Section executive committee held on Aug. 30. One of the most important features of the program will be a "national service survey" such as was proposed at the June convention in New York. This survey will be conducted along lines to be determined by a committee which will work out several optional plans.

President Walter H. Johnson announced that he had appointed all committee chairmen and that all committees were actively at work. He requested and received approval of his appointments of committee chairmen as follows:

Charles A. Coffin Prize—Walter H. Johnson.
Class "C" Membership Applications—Walter Neumuller.
Constitution and Bylaws—W. C. Eglin.
Customer Ownership—Milan R. Bump.
Doherty and Billings Prize Awards—A. S. Loizeaux.
Electrical Resources of the Nation—M. S. Sloan.
Electrification of Steam Railroads—L. A. Ferguson.
Finance—Joseph B. McCall.
Insurance—Charles B. Scott.
Lamp—Frank W. Smith.
Public Policy—Martin J. Insull.
Rate Research—Alex Dow.
Water-Power Development—Franklin T. Griffith.
Accident Prevention—Charles B. Scott.
Company Employees' Organization—T. G. Spates.
Educational—Fred R. Jenkins.
Membership—Howard K. Mohr.
Rural Electric Service (formerly "Rural Lines")—G. C. Neff.
Wiring—R. S. Hale.
Chamber of Commerce of the United States of America—National councilor, John W. Lieb.
Contact Committee, Department of Commerce—George H. Harries.
National Industrial Conference Board—Sloan.
Eastern Seaboard Power Supply Survey Advisory Board, Department of the Interior.—(The two N. E. L. A. representatives are Charles L. Edgar and M. S. Sloan.

Attendance at the national executive committee meeting was exceptionally full, representatives being present from all but one geographic division. These representatives said without exception that conditions in the electrical industry are excellent; in fact, that the industry is enjoying a period of growth and prosperity unequaled in its history.

The meeting of the Public Relations National Section executive committee also was well attended. The program outlined calls for a continued activity on the part of all committees of the section and increased activities with respect to work with employees and co-operative work with other associations, institutions and industries.

N. E. L. A. Adopts New Policy on Sale of Publications

A new policy regarding the distribution and sale of the association's publications has been announced by the N. E. L. A. Free distribution will be limited to one copy of each paper to every member company in good standing, one copy to each geographic division, state association, company section and utility information committee; copies to the members of the committee under whose supervision the paper was prepared, single copies to associations and organizations exchanging like courtesies with the N. E. L. A., to the technical press, to selected libraries throughout the country, to universities, colleges and engineering institutions and to government offices. Additional copies will be sold to members at from 15 cents to 35 cents each and to non-members at from 25 cents to 55 cents each according to the number of pages in the publication, with special prices for orders for any paper in quantities of 25, 100, 500 and more. Advance subscriptions may be entered for all papers dealing with any general or specific subject, as, for instance, all technical papers, all commercial papers, all papers dealing with prime movers, accident prevention, insulators, meters, etc. The *Proceedings* of the 1923 convention will be supplied to members at $5 a copy and to non-members at $10. Complete price lists and further details of the plan will be sent by the association on request.

Del Monte Meeting Plans

Revised Program for A. I. E. E. Pacific Coast Convention to Be Held Next Month

CONSIDERABLE changes have been made in the program for the Pacific Coast convention of the American Institute of Electrical Engineers, to be held at Del Monte, Cal., Oct. 2-5, since it was printed in tentative form in the ELECTRICAL WORLD for July 28. As finally arranged it is as follows, Tuesday being given over to registration and recreation:

WEDNESDAY, OCT. 3

Morning.—Address, Past-president F. B. Jewett; address, "Researches Relating to High-Voltage Transmission," President H. J. Ryan; symposium by transmission engineers of the great West on the mechanical and electrical construction of modern power transmission lines, including insulators for high-voltage lines: "Mechanical-Electrical Construction of Modern Power Transmission Lines," C. B. Carlson and W. R. Battey, Southern California Edison Company; "110-Kv. Transmission Line for Oak Grove Development of Portland Railway, Light & Power Company," H. R. Wakeman and H. W. Lines, Portland Railway, Light & Power Company; "Insulation Design of Anchors and Tower Supports for 110,000-Volt, 4,427-Ft. Span Over Carquinez Strait," L. J. Corbett, Pacific Gas & Electric Company; "Transmission-Line Construction in Crossing Mountain Ranges," M. T. Crawford, Puget Sound Power & Light Company; "Group Operation of System Having Different Frequencies," E. R. Stauffacher and H. J. Briggs, Southern California Edison Company; "Special Features of the Design of Transmission Lines as Imposed by Electrical Conditions," W. Dreyer, Pacific Gas & Electric Company, San Francisco.

Afternoon.—Symposium by transmission engineers of the great West on waterwheel construction, operation and governing, etc.: "Experience with Bearings and Vibration Conditions of Large Hydro-Electric Units," John Harisberger, Puget Sound Power & Light Company; "A Study of Irregularity of Reaction in Francis Turbines," R. Wilkins, Pacific Gas & Electric Company; "Recent Hydro-Electric Developments of the Southern California Edison Company," H. L. Doolittle, Southern California Edison Company; "Upper Falls Development of the Washington Water Power Company," L. J. Pospisil, Washington Water Power Company," Spokane, Wash. Symposium on the practice of high-voltage switches, bushings, lightning arresters and busbars: "High-Voltage Switches, Bushings and Lightning-Arrester Experience of the Southern California Edison Company on its 60,000, 150,000 and 220,000-Volt Systems," H. Michener, Southern California Edison Company; "High-Voltage Circuit Breakers," A. W. Copley, Westinghouse Electric & Manufacturing Company; "Electromagnetic Forces on Bus Supports," L. N. Robinson, Stone & Webster, Seattle; "Test Results on the Performance of Suspension Insulators in Service," C. F. Benham, Great Western Power Company.

THURSDAY, OCT. 4

Morning. — "High-Voltage Insulation," J. L. R. Hayden and C. P. Steinmetz, General Electric Company, Schenectady; "Power Resources of United States" (illustrated), F. G. Baum, San Francisco; "Waterwheel Generators and Synchronous Condensers for Long Transmission Lines," M. W. Smith, Westinghouse Electric & Manufacturing Company; "Performance of Auto-Transformers with Tertiaries Under Short-Circuit Conditions," J. Mini, Jr., Pacific Gas & Electric Company; L. J. Moore, San Joaquin Light & Power Company, and R. Wilkins, Pacific Gas & Electric Company; "Transformers for High-Voltage Systems," A. W. Copley, Westinghouse Electric & Manufacturing Company.

FRIDAY, OCT. 5

Morning.—Symposium on radio communication as applied to power transmission networks: "Carrier-Current Telephony on the High-Voltage Transmission Lines of the Great Western Power Company," J. A. Koontz, Jr., Great Western Power Company; "Recent Developments in Carrier-Current Communication," L. F. Fuller, General Electric Company; "Some Experience with a 202-Mile Carrier-Current Telephone System," E. A. Crellin, Pacific Gas & Electric Company; "Symposium on Theory and Practice in High-Voltage Operation," R. J. C. Wood, Southern California Edison Company; "Economic Consideration of Power-Factor Control of Long High-Voltage Transmission Line," A. V. Joslin, Pacific Gas & Electric Company; "Methods of Voltage Control of Long Transmission Lines by the Use of Synchronous Condensers," J. A. Koontz, Jr., Great Western Power Company; "Applications of Long-Distance Telephony on the Pacific Coast," H. W. Hitchcock, Pacific Telephone & Telegraph Company; "Telephone Transmission Over Long Cables," H. S. Osborne, American Telephone & Telegraph Company.

Thursday and Friday afternoons will be devoted to sports and trips, and on Thursday evening the Edison medal will be bestowed on Dr. R. A. Millikan, following a banquet.

TRIP TO BIG CREEK

R. H. Ballard, vice-president and general manager of the Southern California Edison Company, has extended an invitation to the delegates to visit the Big Creek developments of the company. A two-day inspection trip is planned, starting Friday evening, Oct. 5, and those who make it will be able to observe the scope of the work and in particular the tunnel construction at the discharge end of the Florence Lake Tunnel, the operating plants below Huntington Lake and one end of the 220-kv. transmission line that is operating between the Big Creek plant and Los Angeles.

Work of the New England Public Service Bureau

To diversify further the composition of the committee in charge of the New England Bureau of Public Service Information and to increase the representation of utilities outside Massachusetts upon this board, eleven members have lately been added. They include five representatives of electric light and power companies, W. A. Buttrick, vice-president Twin State Gas & Electric Company; Samuel Ferguson, vice-president Hartford Electric Light Company; Fred D. Gordon, general manager Cumberland County Power & Light Company, Portland, Me.; Edward M. Graham, president Bangor (Me.) Railway & Electric Company, and D. W. Jardine, manager Burlington (Vt.) Light & Power Company.

During the coming winter a speakers' bureau will be established for the presentation of underlying principles and problems of the public utility industry as an industry to representative groups and to the general public, including chambers of commerce, rotary clubs, etc. Radio broadcasts will also be utilized in some of the larger New England cities. Newspaper acceptance and reuse of the bureau's material is running about 30 per cent ahead of a year ago.

Strength of American Public Utilities Company

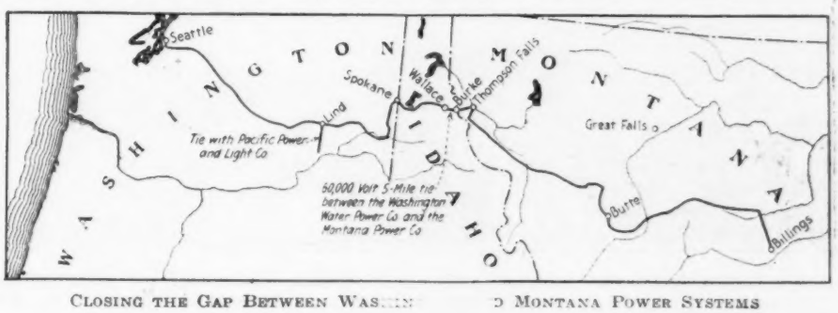
The annual report of the American Public Utilities Company of Grand Rapids, Mich., for the year ended June 30, 1923, shows an improvement in earnings, while reduction of funded indebtedness to $436,000 and elimination of floating debt has strengthened its financial structure. Both the company's preferred issues are now on a dividend-paying basis.

For the year ended June 30, 1923, gross earnings, including those of the Wisconsin-Minnesota plants recently sold to the Northern States Power Company, were $10,508,809, with a balance available for depreciation and dividends of $720,418. With the liberation of the capital employed formerly in the Wisconsin-Minnesota plants and its application to the development of the electric properties in the more populous Indiana territory it is estimated that income available for stockholders based on past record of the Indiana properties and present demand for additional power for the year ending June 30, 1924, will be $1,430,690, compared with $720,418 for the fiscal year just closed.

Linking the Power Systems of Washington and Montana

The five-mile, 60,000-volt tie line now under construction between Wallace and Burke, Idaho, to connect the 60,000-volt system of the Washington Water Power Company with the 110,000-volt system of the Montana Power Company, will, as already stated in these columns, form an interconnected transmission system from Billings, Mont., on the east to Seattle on the west. This is a distance of more than 700 miles. The interconnection, together with a switching station at Wallace and a substation at Burke, will be completed this fall and power will be interchanged between the two systems through transformers at the Burke substation.

Following the completion of this tie and that of the Puget Sound Power & Light Company between Olympia and Tenino, Wash., there will remain only two small gaps of less than 25 miles in the interconnected transmission system of the West, extending for 2,000 miles, from Billings to Mexico.



CLOSING THE GAP BETWEEN WAS...N ...D MONTANA POWER SYSTEMS

Fight on Adirondack Power

Towns and Land Owners Attack Plan for Regulatory District in Lake Region

PUBLICITY has recently been given to the controversy over the petition of the Hanna Paper Corporation and the Power Corporation of New York asking the New York State Water Control Commission to grant permission for the establishment of a Raquette River Regulating District. Opposition to the petition has been registered with the commission by the Adirondack Property Owners' Association, civic and commercial organizations and village authorities as well as individuals in the region that embraces Raquette, Tupper, Long, Forked and Saranac Lakes. These opponents assert that the Power Corporation is seeking a "blanket right to the Raquette Lake district," that there is no public necessity for the creation of the regulating district proposed, that the present flood damage is nominal and would not be lessened by storage, that the state would get nothing for the storage rights, that summer resorts and cottages in the most valuable districts of the Adirondacks would be destroyed if the scheme were carried out, and that the odor from the reservoir basins would become a nuisance and "affect most detrimentally" the United States Veterans' Tuberculosis Hospital now being built near Tupper Lake. If regulation of the river is necessary, opponents say, it can be brought about at less cost and without the use of state land by establishing reservoirs at sites below and outside the summer resort region.

The Power Corporation of New York, which was incorporated in 1922, issued last November a statement in which it said it was about to acquire rights to two sites on the Black River and five sites on the Raquette River, including one on the latter stream as yet undeveloped. The total horsepower upon completion of the proposed storage was estimated by the corporation at 100,000, 37,500 hp. already developed and producing income and 62,500 hp. on the Raquette undeveloped.

J. N. Carlisle of Watertown, N. Y., president of the Power Corporation of New York, is quoted as denying emphatically the contentions of the opponents of the Raquette development and saying that they are men who bought large properties after they knew the regulation district was proposed. Mr. Carlisle points out that the location of any particular reservoir must be settled by the state officers. He asserts that every village on the Raquette River would benefit from storage in the matter of adequate water supply, that it has been estimated the proposed hydroelectric development would do the work annually of a million tons of coal in small steam plants, and that Tupper Lake, which is now a "big swamp," would become a beautiful sheet of water. Any possible injury to the Veterans' Hospital he scouts as a "howling joke."

Cleveland Municipal Plant Needs $1,000,000

The report for 1922 of the Municipal Electric Light Plant of Cleveland seems to show that, regardless of earnings, a municipal plant will be hampered by high operating charges at a low rate of return. While the net earnings were $169,215, as against $27,000 in 1921, the plant remains in need of maintenance and extensive additions to meet the growth of business. The large increase in net earnings, which, however, represent less than 2 per cent net on the investment, is attributed to the fact that the Mayor cut down payrolls and other expenses when the output was reaching its maximum.

The valuation of the plant is given as $7,666,006, and it is rated at 35,000 kw. The total gross earnings for the year were $2,127,846. If tax allowance had been omitted, net earnings would have been $331,048. Toward the depreciation reserve there was added $303,749, increasing this fund to $1,173,604. Some plan may be worked out whereby this reserve can be used in order to get new equipment immediately.

The City Council last year granted a bond issue of $500,000, which went for much-needed new boilers and cables, but this was a small portion of the required new equipment. At the present time, according to Director E. L. Myers, at least $1,000,000 is necessary for improvements. Twice this amount would be better. Since 1917 the number of customers has jumped from 20,197 to 32,036, with a corresponding increase in energy output of 59,000,000 kw.-hr. Immediate action will be necessary in order to increase the plant capacity since the City Council has voted $500,000 for new "white ways," all of which must be lighted from the municipal plant.

Growth of Alabama Power

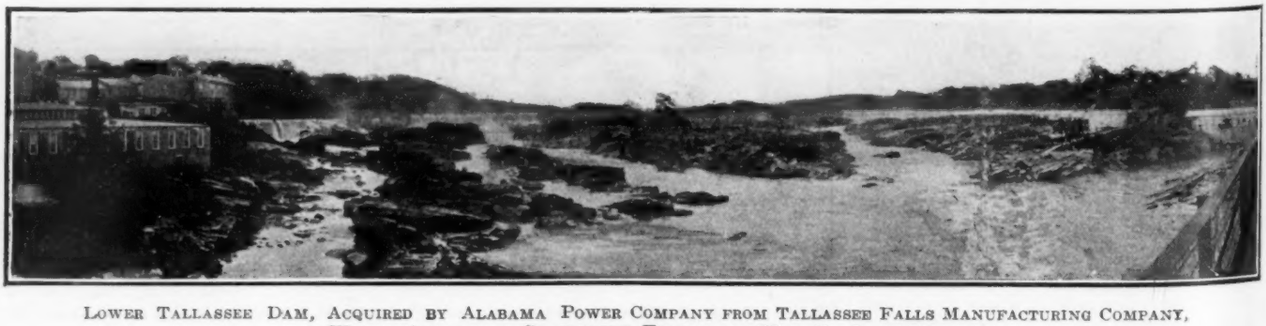
How the Company Contrives to Meet the Increasing Demand on Its Facilities

INDUSTRIAL development in Alabama has attained such an impetus, according to the figures of the commercial development department of the Alabama Power Company, that it is a hard task to fill the demands for energy. These figures, based on signed contracts and indications given by power users of future needs, reveal a state-wide power demand of 211,000 hp. this year as compared with only 150,000 hp. at the close of 1922. Careful estimates on future requirements reveal an expected need at the end of 1926 of 370,000 hp., making a total increase from 1922 to 1926 of 220,000 hp.

Thomas W. Martin, president of the Alabama Power Company, says that during May the power demand reached about 175,000 hp. Signed applications are now on file for 16,000 hp., while lighting and power requests from various consumers indicate a definite demand for a minimum of 20,000 additional horsepower. This rapid growth in the demand for power has been the moving force behind the comprehensive construction program of the Alabama Power Company, which includes the erection of a ten-million-dollar hydroelectric power dam at Cherokee Bluffs, on the Tallapoosa River, to generate 132,000 hp.

TALLASSEE PLANT TO BE ENLARGED

Estimates of contractors show that the Cherokee Bluffs dam cannot with the utmost speed be completed before the end of 1925. In order to care for the demand which will accrue before that time the company will utilize the power house at the dam site acquired when the Montgomery electric properties were taken over and is now rebuilding the dam. The plant at Tallassee Mills will also be enlarged. Immediate power needs are being met by the installation at Mitchell Dam, where the third 24,000-hp. unit has gone into service simultaneously with the completion of the permanent high-tension transmission system. Mitchell Dam's 72,000 hp. brings the company's total hydroelectric output to 184,000 hp., and provision has been made for two additional 24,000-hp. units to be ultimately installed at the dam.



LOWER TALLASSEE DAM, ACQUIRED BY ALABAMA POWER COMPANY FROM TALLASSEE FALLS MANUFACTURING COMPANY, WHERE ADDITIONAL GENERATING EQUIPMENT WILL BE INSTALLED

I. C. C. Experts Report Against Staley Electric Line

Interstate Commerce Commission examiners have recommended that the application of William L. Staley for authority to construct an electric railway to be known as the Staley System of Electrified Railways in Arizona, New Mexico, Colorado and California be denied.

The application asked authority to construct a line which with branches would total 1,240 miles in the United States and 66 miles in Mexico. The whole territory to be traversed by the proposed line, the commission's examiners declared, appeared to be well served by existing railroads. The report made the further statement that the applicant had "grossly overestimated traffic possibilities."

Construction costs have been estimated by the Staley interests at about $76,000,000, with an additional $27,000,000 for power supply and about $30,000,000 for the purchase of equipment. The examiners declared, however, that no actual surveys had been made and that there was no method of ascertaining except by estimate what the actual construction costs would be.

Harriman Talks of Deerfield Power Development

"When completely developed the Deerfield River will be the most highly utilized stream for its drainage area in the Eastern States and one of the most complete examples of water-power conservation in the United States," said President Henry I. Harriman of the New England Power Company recently at Boston. "During the past eight or nine years," he continued, "the company has developed heads aggregating about 500 ft. on this stream and has built a large storage reservoir at Somerset, Vt., to equalize the flow. The new hydro-electric plants at Searsburg and Davis Bridge add 600 ft. to the total developed fall, and with these the storage capacity is being trebled. When these latter developments are completed, there will still be about 45,000 kw. undeveloped power below Davis Bridge. When this is developed the river will have a total developed capacity of about 135,000 kw. of primary regulated power. The new reservoir above Davis Bridge will have a capacity of 5,000,000,000 cu.ft., compared with 2,500,000,000 at Somerset. The flow of the river, formerly a 'flash' stream, will thus be made practically uniform."

Federal Departments at Odds as to New Coal Mines

Considerable interest has been aroused in Washington by the conflict between the attitudes of the Interstate Commerce Commission and the Interior Department toward opening new soft coal mines. As already reported, the Interstate Commerce Commission recently denied the Virginian Railway permission to build a branch line 1.19 miles in length in Wyoming County, W. Va., to reach a proposed coal mine, saying at one place in its decision: "There are at present more mines in the country than is consistent with the most efficient use of carriers' equipment, and their aggregate capacity exceeds greatly the country's demand."

While one government agency thus gives what appears to be a general declaration that too many coal mines are in existence in the country, the Department of the Interior has announced the sale at public auction of mineral rights to 1,840 acres of public land in Fayette County, Ala. The coal rights were purchased by Moss & McCormick of Birmingham, who paid a cash bonus of $85,000, with a pledge to spend $75,000 for improvements on the property within three years and to guarantee the government a royalty of 10 cents per ton per annum on a minimum production of 20,000 tons of coal, the stipulations meaning that the coal must be mined.

Landing the New Atlantic Cable

THE above photograph, by Alexander A. Brown, shows the shore end of the Commercial Cable Company's new European cable being floated in to land at Far Rockaway, N. Y., from the lighter in the distance. The buoys attached to the cable are being removed as they float in to shore.

Brief News Notes

Editor Condit to Give Radio Talk.—The second of the four radio talks to be given this month by editors of McGraw-Hill publications will take place on Wednesday, Sept. 12, when Kenneth H. Condit, editor of the *American Machinist*, will speak about "Automatic Machines and Their Effect on Men."

Bristow, Okla., Has New Substation.—The new substation of the Oklahoma Gas & Electric Company at Bristow was recently placed in service. New equipment costing approximately $75,000 has been installed. Ample capacity has been provided for the city's future growth. R. G. Justice is the local manager.

Feather River Development.—A permit has been granted by the California Department of Public Works to Guy Wilkinson of Oroville, Cal., to use 15,000 sec.-ft. from the Feather River in Butte County. The permittee intends to develop 47,659 hp. at a cost of $300,000.

Middle West Subsidiaries Consolidate.—Stockholders of the Central Illinois Public Service Company and the Middle West Power Company, both subsidiaries of the Middle West Utilities Company, have voted to consolidate. The consolidated company will own the 50,000-kva. power plant under construction in the Mississippi River at Grand Tower, Ill., and a 66,000-volt steel tower transmission line now being built to deliver energy from that station to the coal fields and communities of southern Illinois.

Kansas' New Power Plant Will Serve Both Topeka and Atchison.—It is announced that C. A. Leland, superintendent of the Atchison Railway, Light & Power Company, will have charge of the construction of the three-million-dollar power plant which, as already reported in these columns, the McKinley interests are to build at Tecumseh, on the Kaw River, a few miles from Topeka. This plant will serve Atchison as well as Topeka, and transmission lines are to be built to both cities, whose respective central-station companies have a joint interest in the building of the plant.

Iowa Electric Company at Odds with Maquoketa Authorities.—Legal action is being taken by the Iowa Electric Company of Cedar Rapids in an effort to prevent the city authorities of Maquoketa from installing a municipal lighting system. The company asserts that the city has constructed its lines so

that the property of the plaintiff is in danger of damage. It also alleges that the purpose of the city is to destroy the plaintiff's rights and property in Maquoketa, and it asks the court to enjoin the city from such action and that the contract between the city and the contractor be declared null and void.

Lightning Interrupts Service on British Columbia System.—Lightning of unusual severity recently caused a complete interruption of service on the system of the British Columbia Electric Railway Company in the early morning. The three cables carrying power from the Lake Buntzen plants were put out of commission and the machines in the Stave Lake plant were burned out, leaving only a small amount of power available. The 17,000-kw. steam standby plant in Vancouver was hurriedly pressed into service but was of insufficient capacity to carry the light and power load and street-car service had to be suspended.

Interstate Power Company Has New 33,000-Volt Transmission Line.—The Interstate Power Company is completing and will soon have in operation its new high-power transmission line from Postville to Ossian, Iowa. The former 13,200-volt line has been entirely rebuilt to give more direct connection with Galena, Ill., and Prairie du Sac, Wis. When completed it will operate at a voltage of 33,000, enabling the company to give better electric light and power service to Waukon, Decorah, Cresco, Lansing and other northeastern towns. Instead of copper wire steel cord inside of aluminum wire has been used.

Pennsylvania Power & Light Absorbs Three Properties.—A formal transfer of the franchises and assets of the Lycoming Edison Company of Williamsport, Pa., to the Pennsylvania Power & Light Company has been made. The Pennsylvania Power & Light Company is also absorbing the Jersey Shore (Pa.) Electric Company and the Lock Haven (Pa.) Light, Heat & Power Company. A new division has been established to be known as the Williamsport division, of which Lewis W. Heath of Grand Rapids, Mich., has been appointed manager. With the acquisition of the properties named the Pennsylvania Power & Light Company extended its operations from Lock Haven to the Delaware River, serving 150 communities.

Superior's Plants Still the Property of Central-Station Company.—The Wisconsin Railroad Commission at the instance of attorneys for the city of Superior has handed down a decision rescinding the order issued in March which transferred the title of the plants of the Superior Water, Light & Power Company to the city. This action was taken, it is understood, "to correct an error" made in issuing the March order, the error being that the transfer order was issued before the final valuation of the company's properties had been determined. Just what effect the most recent action of the commission will have on the proceedings to acquire the utilities is not yet entirely clear, but the decision definitely establishes that the plants are still the property of the company.

Blue Island Now Buys Utility Power.—As a result of an engineering investigation the City Council of Blue Island, a suburb of Chicago, has sold the municipally owned electric light and power distribution system to the Public Service Company of Northern Illinois. A thirty-year franchise has been granted besides an agreement whereby the Council may sell its street-lighting system to the company within a year. The reason for this change-over was the need of a new generating plant, which would have cost $293,000 with a yearly operating expense of $100,000, an outlay the Council shrank from incurring. The plant serves 12,000 domestic customers besides many industrial plants. The Blue Island generating plant of the Public Service Company of Northern Illinois, just south of the city limits, is conveniently situated to handle the increase in load.

Westinghouse Summer Conference for Engineering Teachers Well Attended.—Twenty-one teachers of engineering from twenty-one widely separated colleges and universities spent the month of July in the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company renewing their contact with industry in the interest of better teaching. A similar program was conducted at the company's South Philadelphia plant. This is the thirteenth consecutive season that a group of engineering teachers has gathered at the Westinghouse company's plants and during these years more than four hundred engineering teachers, representing every engineering college in the United States and many of the leading institutions in foreign lands, have participated in the conferences.

General Tripp on "The Electrification of North America."—General Guy E. Tripp, chairman of the board, Westinghouse Electric & Manufacturing Company, contributes to the *World's Work* for September an illustrated article entitled "The Electrification of North America—What the Superpower Plan Means and How It Can Be Carried Out." In this article General Tripp explains the plan for continental electrical interconnection, dwells upon the great part that water power must play in such a project, alludes to the superpower systems already in operation on the Pacific Coast, in New England, the Southeastern States and the Northwest and those in process of formation, and tells of the detailed plans already drawn up by Frank G. Baum. Attempts, General Tripp says, may be made to bring about federal ownership of the nation-wide power system when it becomes a fact. Opposing this idea as inefficient and unworkable, he favors constructive and stimulating but not restrictive government regulation. "The one essential," he concludes, "is to remember that the aim in view is the maximum prosperity of the nation and of every inhabitant of it."

Associations and Societies

Electrified Foundry at Iron and Steel Engineers' Exposition.—Special attention is called by the Association of Iron and Steel Electrical Engineers to the complete electrified foundry which will be in actual operation, producing finished castings, at the exposition to be held in the Broadway Auditorium at Buffalo, N. Y., in connection with the annual meeting of the association on Sept. 24-28. Starting with the electric furnace, every operation known in modern foundry practice will be exemplified, and as this is the first time that this feat has been attempted in America, it is expected to attract thousands of foundrymen. The names of the papers to be presented at the meeting, with their authors, were printed in the ELECTRICAL WORLD for Aug 25, page 402.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

Pennsylvania State Association of Electrical Contractors and Dealers—Wilkes-Barre, Sept 12-13. M. G. Sellers, 15-18 Sansom Street, Philadelphia.

Conference of Electrical Leagues—Association Island, Sept. 17-19. Society for Electrical Development, New York.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Association of Edison Illuminating Companies—Dixville Notch, N. H., Sept. 17-21. P. S. Millar, 84th St. and East End Ave., New York.

Michigan Electric Light Association—Grand Rapids, Sept. 18-20. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

International Association of Municipal Electricians—Reading, Pa., Sept. 25-28. C. R. George, Houston, Tex.

Great Lakes Division, N. E. L. A.—French Lick Springs, Sept. 26-29. R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.

Indiana Electric Light Association—French Lick Springs, Sept. 26-29. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

National Safety Council—Buffalo, Oct. 1-5.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 8-9. C. H. B. Chapin, Grand Central Terminal, New York.

Association of Electragists International—Washington, Oct. 8-13. Farquson Johnson, 15 West 37th St., New York.

American Electric Railway Association—Atlantic City, N. J., Oct. 8-13. J. W. Welsh, 8 West 40th St., New York.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Oct. 19-20. Herbert Smith, Robson-Prichard Bldg., Huntington.

Electric Power Club—French Lick Springs, Ind., Nov. 19-22. S. N. Clarkson, 900 B. F. Keith Bldg., Cleveland.

Commission Rulings

Two Methods of Dealing with Accrued Depreciation.—In fixing a rate base for the Duluth Street Railway Company, which operates lines in Superior, Wis., the Wisconsin Railroad Commission found that the determination of accrued depreciation would be a heavy task and decided, instead of attempting it in order to arrive at the actual fair value of the property, to achieve the same object in another way. Explaining its course, the commission said: "There are two methods by which such consideration may be given. Under the first of these the company would be allowed to earn a return upon the property value after giving effect in such value itself to accrued depreciation. Where this is done the provision for depreciation would be made entirely by a charge to operating expenses. No interest credit could be required to be made to the reserve since the deduction of depreciation in the rate base in effect excludes from such rate base property built by the reinvestment of the reserve. A second method of giving consideration to accrued depreciation, although the effect of such depreciation is not measured by a deduction from the rate base, is to compute the rate of return upon the rate base before giving effect to accrued depreciation, which means that the utility is permitted to earn a return upon all property, including that built from reinvested reserves, and to provide for a credit of interest to the reserve based upon the reserve balance. This in effect constitutes a payment of interest to the reserve for the use of reserve capital exactly comparable to the payment of interest on a funded debt. Therefore, when a rate base is determined without giving effect to accrued depreciation in the base itself, no injustice is done to the consuming public as long as the company is required to utilize a proper part of the return which it is allowed to earn upon its total property as a credit to the depreciation or retirement reserve."

High Rates May Not Be Excessive in View of Supreme Court Ruling.—Dissent was registered by one member of the Pennsylvania Public Service Commission from the schedules ordered for the Luzerne County Gas & Electric Company on the ground that they provided an excessive return. This led another member of that body to file an individual report concurring with that of the majority. In this report he said: "The commission, in the disposition of the present complaint against excessive rates, is confronted with the alternative of either permitting and approving a rate schedule that will produce an amount sufficient to provide for a minimum allowance for operating expenses, depreciation and fair return, or disregarding the decisions of both the state and federal Supreme Courts, which have repeatedly held that rates shall not be confiscatory and that they are confiscatory when they will not yield a return which will at least approximate the legal rate of interest on the fair value of the used and useful property devoted to the public service over and above reasonable operating expenses and a proper allowance for depreciation. . . . Valuation was not an issue in the present proceeding and is conclusive on the commission, and while there is general agreement among the commissioners that the rates which must be charged for the services rendered to produce the required revenues to which the respondent is entitled are unusually high they cannot be termed excessive since there is no escaping the fact that they cannot, under the law of confiscation as declared by the courts, be made any less having due regard to the fair value of respondent's property as heretofore fixed by the commission and a minimum allowance for operating expenses and depreciation. For the reasons stated I prefer to go along with the majority report rather than to flout the decisions of state and federal courts."

Recent Court Decisions

Owner of Dam Given Time to Determine Height That Will Not Injure Plaintiff.—In Harp vs. Iowa Falls Electric Company the Supreme Court of Iowa modified a decree requiring abatement of a dam so as not to back water on plaintiff's premises by extending the time for the abatement and permitting the owner of the dam during that time to ascertain by experiment the height to which the dam can be maintained without causing the water to back up above plaintiff's lower property line. (194 N. W. 353.)*

What Constitutes Discrimination?—Confirming the dismissal of a complaint brought by the Cleveland & Eastern Traction Company against the Public Utilities Commission regarding rates filed by the Cleveland Electric Illuminating Company and approved by the commission which the Cleveland & Eastern company held to be in violation of a contract between it and the lighting company, the Supreme Court of Ohio held the commission's order to be in accord with the statutes and observed further: "A classification approved by the Public Utilities Commission which embraces in one class consumers guaranteeing a minimum demand of 500 kw. for combined electric railway and commercial uses, which has application to interurban companies procuring current from a power company at or beyond the limits of the city within which the power plant is located, and in another class electric railways guaranteeing a minimum demand of 20,000 kw. for electric railway purposes only, and which demand is constant and steady, such service being in said city and within a relatively short transmission distance, is a lawful and reasonable classification." (140 N. E. 139.)

To Predicate Damages on Discontinuance of Service Customer Must Tender Amount He Concedes to Be Due.—Reversing a verdict for the plaintiff in Nelson vs. Mobile Electric Company, a suit for damages because of the discontinuance of electric service owing to a disputed bill, the Supreme Court of Alabama declared that the rule that a company which ceases to furnish electricity because of a customer's failure to pay therefor, when his liability or the accuracy of the amount claimed is a matter of just dispute between the parties, acts at its peril is subject to the qualification that when the customer concedes a certain amount to be due he must pay or tender such amount. Failing to do so, he cannot complain that defendant's discontinuance of service was wrongful. It was not necessary, however, for the customer to allege the existence of a contract. (96 So. 713.)

Rules Governing Valuation.—In State ex rel. Capital City Water Company vs. Public Service Commission of Missouri, the Supreme Court of Missouri affirmed rates fixed by the commission for the water company, making these observations on the principles of valuation that the regulating body follows: "The Public Service Commission, in considering historical cost and cost to present owner of a public utility as a basis for fixing rates for the future, properly disregards so-called past losses or deficits arising from its net returns not being so great as it is claimed they should have been, the law not having prescribed any such return and such deficit not being a subject for capitalization. The commission, in arriving at depreciation, in determining reproduction cost new less depreciation, properly declines to be bound by either the 'sinking-fund method' or the 'straight-line method.' It properly disallows a hypothetical brokerage fee." Defining "going value" as the value distinct from good will which inheres in a plant where the business is established as distinguished from one which has yet to establish its business, the court said that good will should not be considered in valuation for rate making. It averred that what is a reasonable rate for a public utility in any given case is a question of fact, calling for the exercise of sound judgment and common sense of the commission, which is not bound by any hard and fast rule nor required to fix rates according to any general formula, nor according to any unvarying percentage of the value of the property in use. (252 S. W. 446.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

C. S. MacCalla Vice-President and General Manager of Pennsylvania-Ohio Company

C. S. MacCalla has been made vice-president and general manager of the Pennsylvania-Ohio Electric Company, the Youngstown Municipal Railway Company and other subsidiaries of the Pennsylvania-Ohio system, succeeding Garrett T. Seely, who recently resigned. Mr. MacCalla, who assumed the duties of his new office on Sept. 1, brings to his new field of activity a wide and varied experience in public utility operation. Immediately after his graduation from Lehigh University in 1896 he entered the installation department of the Philadelphia Bell Telephone Company and soon afterward spent a brief period with the Edison Electric Light Company of Philadelphia, now the Philadelphia Electric Company. Subsequently he became identified with the Edison Electric Illuminating Company of Brooklyn (the Brooklyn Edison Company), where he served successively as draftsman, construction boss and general construction foreman. In 1903, following two years' electric railway work in the foreign department of the General Electric Company, Mr. MacCalla went to the Pacific Coast, where he allied himself with the Washington Water Power Company, Spokane, serving for fifteen years as assistant to the general manager, assistant general manager, general manager and vice-president and general manager.

Returning to the East, Mr. MacCalla became vice-president and general manager of the Virginian Power Company, Charleston, W. Va., which position he recently resigned. During his residence in West Virginia he was appointed by the Governor to the State Board for Registration of Engineers and as a delegate to represent the state at a water-power conference in New York in February, 1922. Mr. MacCalla is an active member of the American Society of Civil Engineers and a fellow of the American Institute of Electrical Engineers.

C. S. Roadhouse, formerly superintendent of the municipal light plant at Walnut, Iowa, is now connected with the engineering department of the Nebraska Power Company, Omaha.

Graham Bright, formerly general engineer in charge of the coal and metal mining activities of the Westinghouse Electric & Manufacturing Company, has joined the firm of Howard N. Eavenson & Associates, mining engineers of Pittsburgh. Mr. Bright will give special attention to power-house systems, power-plant appraisals, transportation and transmission systems for coal and metal mines, and general industrial power applications. He became associated with the Westinghouse company in 1898, soon after being graduated from the University of Pittsburgh, and has been with the company almost continuously since.

H. C. Blackwell Heads Missouri Association

H. C. Blackwell, the new president of the Missouri Association of Public Utilities, has been vice-president and general manager of the Kansas City Power & Light Company since 1917.

H. C. BLACKWELL

After graduation from Purdue University in 1902, Mr. Blackwell was employed by the William B. Scaife & Sons Company, Pittsburgh, in the water-softening and purification department. In 1904 he served with the Wabash Railroad Company, but a year later joined the J. G. White Company of New York, where his work consisted in the construction of an interurban railway between Alton and East St. Louis, Ill. From 1906 to September, 1917, Mr. Blackwell filled various capacities with the People's Light Company at Davenport, Iowa, from engineer up to vice-president and general manager. He also served as gas engineer from 1914 to 1917 for the United Light & Railway Company. At this latter date he became associated with the Kansas City Power & Light Company in his present capacity.

C. F. Laible, formerly of the Chicago office of the Edison Storage Battery Supply Company, has been appointed district manager for New England, with headquarters in Boston. Mr. Laible succeeds George W. Holden, who recently left the service of the company.

John H. Albert, formerly associated with the operating department of the Brooklyn Edison Company, has severed his relations with the company.

E. F. Ryder has recently been made manager of the Oshkosh division of the Wisconsin Public Service Corporation's properties.

J. I. Mange, formerly vice-president of the Liberty (N. Y.) Light & Power Company, is now president of the company, succeeding Henry R. Taylor. C. A. Greenedge is vice-president.

Arthur E. Scott, for many years manager of the Atlantic Tank & Barrel Company of Louisville, has recently allied himself with the Interstate Public Service Company, Indianapolis, as director of relations.

E. M. Sweeley, president of the Public Utilities Commission of Idaho, has resigned. Mr. Sweeley, who was appointed to the commission in 1919, will be succeeded by Fred C. Graves of Filer.

Charles W. Brown, who has been associated with the Adirondack Power & Light Corporation for four years in various capacities, has severed his connection with the company to ally himself with the Service Appliance Company of Schenectady.

Leonard A. Doggett, who has been in charge of electrical engineering instruction of naval officers in the Post-Graduate School at Annapolis, Md., for the past ten years, has resigned to enter the department of electrical engineering at the Pennsylvania State College, State College, Pa.

Carl D. Luscomb, for several years assistant to C. A. Semrad, vice-president and general manager of the Western Light & Power Company, which was recently merged with the Denver Gas & Electric Light Company to form the Public Service Company of Colorado, has been appointed general superintendent of the division operated by the former company and will continue his headquarters at Boulder, Col.

Fred Fair, prominent geologist and irrigation engineer of Boulder, Col., has been appointed to the executive staff of the Lakeside Construction Company, which is now building the new twelve-million-dollar steam generating plant for the Public Service Company of Colorado at Valmont, close to Boulder.

Charles S. Banghart, general manager of the Augusta-Aiken Railway & Electric Company of Augusta, Ga., which is under the management of the J. G. White Management Corporation, New York, has resigned to accept the position of vice-president of the Staten Island Edison Company and the Richmond Light & Railroad Company, with offices at St. George, Staten Island, New York City. These companies are also under the management of the White corporation. F. Bayard Culley, assistant secretary and treasurer of the company at Augusta, has been selected to succeed Mr. Banghart.

Emerson Pugh, instructor in electrical engineering at Purdue University, has resigned to enter the development engineering division of the Western Electric Company at Chicago.

J. F. Orr, sales manager of the Idaho Power Company, has been appointed chairman of the range committee of the National Commercial Section of the National Electric Light Association.

Benjamin Robinson, chief electrician at the plant of the Bristol Brass Corporation of Bristol, Conn., has resigned recently. Mr. Robinson will devote his time to private research work.

Howard Corning of the Bangor (Me.) Railway & Electric Company has accepted the chairmanship of the rate committee of the New England Division of the National Electric Light Association.

H. L. Erlicher, formerly assistant to the general purchasing agent of the General Electric Company, has been named assistant general purchasing agent. Mr. Erlicher assumed his new duties Aug. 1.

P. J. Wilson of the Lowell (Mass.) Electric Light Corporation has accepted the chairmanship of the Power Bureau of the New England Division of the National Electric Light Association. The bureau is affiliated with the New England Association of Central Station Power Engineers.

W. B. Stover, who has been meter engineer for the Westinghouse Electric & Manufacturing Company with headquarters in Atlanta, has allied himself in the same capacity with the Southern Public Utilities Company, succeeding W. D. Alley, who recently became manager of the resales department of the Winston-Salem branch of the company. Mr. Stover assumed his new duties Sept. 1.

C. S. Walker, formerly president of the Varney Electrical Supply Company of Indianapolis and Evansville, Ind., has resigned his position to become secretary and treasurer of the Interstate Electric Company of New Orleans. Mr. Walker had been associated with the Varney Electrical Supply Company for more than twenty-five years.

John F. Cunningham, Jr., has been appointed assistant manager of the production department of the Schenectady works of the General Electric Company. Mr. Cunningham has been associated with the company since 1901, serving during that time in the armature department, the production department and more recently in the works manager's office in the capacity of special representative.

Magnus W. Alexander, managing director of the National Industrial Conference Board, New York, who has been studying industrial and economic conditions throughout the allied nations and Central Europe for the board, returned to this country on Friday, Aug. 31, on the *Resolute*. Mr. Alexander, who is a distinguished electrical engineer as well as an industrialist, being on the consulting staff of the General Electric Company, addressed meetings of industrialists in England, Germany and Austria. The results of his inquiries will be made known formally at the next meeting of the board on Sept. 20 at the Hotel Astor, New York City. Mr. Alexander has been peculiarly qualified to make this first-hand European survey at a crucial time by reason of his long leadership in the study of industrial problems. He has been identified with numerous industrial commissions and was named by President Harding on the advisory committee of the superpower commission to study electric development.

C. A. Morris, superintendent of the Northern Indiana Gas & Electric Company's power house at Michigan City, Ind., has been promoted and transferred to the East Chicago power house of the company. He formerly was employed at the East Chicago plant and a few years ago took the position of power superintendent with the South Shore Railroad. When the power house was taken over by the Northern company in October, 1921, he was retained as the superintendent. Donelly Leeds, present chief electrician at the power plant, has been promoted to succeed Mr. Morris.

A. N. Greene has resigned as publicity agent of the Century Electric Company, St. Louis, to become sales manager for the Watlow Electric Manufacturing Company, manufacturer of electric heating devices, also at St. Louis. K. G. Eaker, who was graduated from Purdue University in electrical engineering with the class of 1923, will succeed Mr. Greene as publicity agent for the Century Electric Company.

Clinton Stark, formerly manager of supply sales of the Sprague Electric Company and more recently general manager of the Bonnell Electric Manufacturing Company, has joined the Westinghouse interests as special agent. He will be associated with John J. Gibson, vice-president of the Westinghouse Commercial Investment Company, with headquarters in New York.

Obituary

Oliver T. Harvell, a commercial engineer with the Georgia Railway & Power Company, Atlanta, for the past fourteen years, died recently at his home in Atlanta at the age of forty years. Mr. Harvell was well known in public utility circles in the South.

Gilbert F. Grider, superintendent of the Marshall (Ill.) light and water systems, died as the result of injuries recently received when an electric light pole upon which he was working broke and fell to the pavement. Mr. Grider was twenty-six years of age and had been employed at Marshall as light and water superintendent since May 1.

Delwyn Dessar, assistant engineer with the Duquesne Light Company, Pittsburgh, was killed in an automobile accident early last month. Mr. Dessar, who was a graduate of the University of Nevada, had been connected with the De La Vergne Machine Company, New York, the Nevada Valleys Power Company, and with the General Electric Company both in Schenectady and in New York. In 1922 he became identified with the Duquesne company.

Edward J. Hunt, managing owner of the Edward J. Hunt Manufacturing Company, Newark, N. J., died on Aug. 11. Mr. Hunt was a graduate in electrical engineering of Tufts College in 1892 and subsequently spent fourteen years in various departments of the General Electric Company. In 1913 he established the manufacturing business in Newark, where he built transformer oil drying and testing apparatus of his own design. Mr. Hunt was inventor of a number of electrical devices.

Hertha Ayrton, British engineer and the only woman member of the Institution of Electrical Engineers, died on Aug. 27 in Lancing, Sussex. Mrs Ayrton invented and constructed a line divider and assisted in the completion of a series of experiments on the electrical arc. She was nominated for a fellowship in the Royal Society in 1902, but the society's counsel gave an opinion that the organization had no power to elect a woman.

J. Alfred Landry, president of the Lake Charles (La.) Railway, Light & Waterworks Company since its organization thirty-two years ago, and one of the most prominent citizens and business men of the city, died on Thursday, Aug. 9. Mr. Landry, who was sixty-four years of age, had been in failing health for the last few years. He was an early and ardent advocate of public utility development in Lake Charles, and his activities in connection with the starting of the ice plant, the installation of electric lighting and the electrification of the street railway are an important part of the story of the growth of the city, to which he came first as an unknown country boy.

Frank G. Drum, formerly president of the Pacific Gas & Electric Company and one of the leading figures in the financial life of California, died suddenly as the result of a hemorrhage on Tuesday, Aug. 28, at his home in San Francisco. Mr. Drum was associated with the development of many of California's leading corporations. He was president of the Pacific Gas & Electric Company for a period of thirteen years, from 1907 to 1920, when he resigned in favor of Wigginton E. Creed, but continued as a member of the executive committee and the board of trustees. He served as executive manager of the Haggin and Tevis interests in California for thirty years. At the time of his death he was president of the Yosemite Valley Railroad Company, vice-president of the Mercantile Trust Company, of which his brother, John S. Drum, is president, and an officer and director in many other enterprises.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Great Additions to Wealth of Industry

Details from an Analysis of the Capital, Surplus and Inventories of Seven of the Largest Electrical Manufacturing Corporations of America

IN TERMS of cash, inventories and working capital industry has never been in a stronger position than it is today. This is true of all the principal industries of America, and also of the principal manufacturers of the electrical industry.

An extremely interesting analysis of 141 representative companies engaged in manufacturing in the United States has recently been compiled and published by the *Wall Street Journal*, embracing complete statistical reports from all these sources. It shows a combined working capital as of Dec. 31, 1922, of $4,441,778,556 as compared with $1,935,788,984 on Dec. 31, 1914, a gain of $2,505,989,572.

The inventories of these 141 companies on Dec. 31, 1922, totaled $2,620,925,133, compared with $2,654,094,870 on Dec. 31, 1921, $3,655,203,299 on Dec. 31, 1920, and $1,220,343,337 on Dec. 31, 1914. Cash and investment holdings Dec. 31, 1922, were $1,678,935,338, equal to nearly 40 per cent of working capital on the same date. Capital liabilities show an increase since Dec. 31, 1914, of $2,488,987,317, not including dividends in stock. These 141 corporations from Dec. 31, 1914, to Dec. 31, 1922, showed a combined surplus after all charges, including dividends, of $3,069,431,945.

Listed among these companies as selected to give a cross-section of American industry are these seven prominent electrical corporations:

Allis-Chalmers Manufacturing Co.,
American Telephone & Telegraph Co.,
Electric Storage Battery Company,
General Electric Company,
Otis Elevator Company,
Western Union Telegraph Company,
Westinghouse Electric & Mfg. Co.

The data presented on these seven companies have been lifted out and incorporated in the accompanying table, and the figures present a striking comparison. The combined

Comparison of Capital Income and Earnings

	Working Capital Dec. 31, 1922	Working Capital Dec. 31, 1914	Increase, Dollars	Increase, Per Cent	Cash and Investment Securities Not of Subsidiaries Dec. 31, 1922	Increase or Decrease in Capital Liabilities Less Dividends in Stocks 1914–1922	Earnings Available per Share Common for Common, Total 8 Years	Av. Earnings Available for Common per Year, per Cent	Added Value per Common Share, 8 Years
Allis-Chalmers	$23,838,021	$11,495,089	$12,342,932	108	$10,391,478	none	$58.55	$7.32	$43.26
American Tel. & Tel.	99,695,528	20,194,755	79,500,773	393	119,680,314	*I* $435,496,754	51.80	6.48	7.40
Electric Storage Battery	17,865,639	3,224,778	14,640,861	455	2,485,474	1,979,325	*C* 31.20	3.90	21.75
General Electric	179,680,280	72,035,317	107,644,963	149	85,341,538	73,812,769	96.40	12.05	50.20
Otis Elevator	13,321,565	4,661,705	8,659,860	186	6,978,322	— 290,044 —	67.69	8.46	41.79
Western Union	18,033,877	10,218,080	7,815,797	76	23,441,462	12,286,518	86.33	10.79	33.36
Westinghouse Elec. & Mfg. Co.	*A* 90,286,743	*F* 28,230,469	62,056,274	220	*A* 7,909,333	46,409,113	*H* 69.50	*H* 8.68	27.45
Total	$442,721,653	$150,060,193	$292,661,460	...	$256,227,921	+ 569,979,479 + — 290,044 —	$461.47		$225.21
						$569,699,435 net, +			

Comparison of Inventories

	1922	1921	1920	1919	1918	1914
Allis-Chalmers	$10,009,030	$12,504,188	$19,659,335	$13,646,367	$17,436,478	$4,149,243
American Telephone & Telegraph	none	none	none	436,707	none	none
Electric Storage Battery	*G* 7,928,280	*G* 6,960,133	*G* 10,313,479	4,894,660	5,528,591	1,726,381
General Electric	75,334,562	64,848,189	118,109,174	83,978,463	88,305,681	29,292,763
Otis Elevator	3,680,738	2,572,181	3,033,787	5,287,519	4,574,656	3,175,889
Western Union	5,685,980	8,152,929	8,713,133	4,913,479	1,545,939	1,926,900
Westinghouse Electric & Mfg. Co	*A* 68,971,104	*B* 55,027,059	*C* 80,724,389	*G* 63,018,123	*E* 59,550,262	*F* 13,307,795
Total	$171,609,694	$150,064,679	$240,553,187	$176,175,318	$176,941,607	$53,578,971

Earnings Retired for Surplus Each Year After All Cash Dividends

	1922	1921	1920	1919	1918	1917	1916	1915
Allis-Chalmers	$22,908	$29,827	$1,647,207	$1,819,540	$3,006,444	$2,392,115	$1,738,565	*G* $602,868
American Telephone & Telegraph	13,199,176	11,328,301	16,444,423	9,039,457	8,671,623	5,989,492	5,891,090	5,518,047
Electric Storage Battery	3,489,154	2,104,891	2,594,557	961,702	1,482,395	1,377,915	932,089	710,784
General Electric	12,157,391	8,243,290	11,476,066	15,532,502	7,939,360	17,768,102	10,467,882	3,607,992
Otis Elevator	1,037,103	762,112	2,490,277	1,216,191	303,913	90,688	28,012	27,094
Western Union	3,790,845	2,378,482	5,969,740	2,196,476	3,270,584	4,680,341	5,685,100	5,351,048
Westinghouse Elec. & Mfg. Co	6,278,587	—47,506	6,632,642	9,221,442	9,822,224	9,794,832	14,049,980	6,859,929
Total	$39,975,164	$24,799,397	$47,254,912	$39,987,310	$34,496,543	$42,093,485	$38,792,719	$22,677,762

A. 1923, *B*. 1922, *C*. 1921.
D. 1920, *E*. 1919, *F*. 1915.
G. Based on aggregate shares of both classes as they receive dividends equally after 1 per cent on each class. This aggregate was increased from 199,793 to 799,173 shares during 1922. 1922, 1921 and 1920 figures are consolidated with those of Willard Storage Battery, all the stock owned.
H. Based on aggregate shares of both classes; common and preferred share alike after 7 per cent on common.
I. From general statements of American Telephone & Telegraph Company, which do not include those of associated companies except that part of earnings paid as dividends to parent company. Proceeds from increase in capital liabilities by sale were used chiefly in acquisition of minority stocks of associated companies.

working capital of these seven electrical companies on Dec. 31, 1922, was $442,721,653 as against $150,060,193 on Dec. 31, 1914, a gain of $292,661,460. Their inventories totaled $171,609,694 as compared with $150,064,679 at the end of 1921, $240,553,187 a year before and $53,578,971 on Dec. 31, 1914. Their cash and investment holdings on Dec. 31, 1922, were $256,227,921, which was equal to nearly 58 per cent of their working capital on the same date. They showed net increase in capital liabilities of $569,699,435, not including dividends in stocks, and a combined surplus for the eight years after all dividends were paid of $290,377,292.

The common stocks of some twenty-seven of the 141 companies were selling far below their value considering the combined surplus, after dividends were paid. Among these are noted:

	Market Sept. 1	Added Value in Eight Years
Allis-Chalmers	43⅜	$43.26
General Electric.....	179	50.20
Otis Elevator.....	121	41.79

There were many instances, however, where corporations failed to retain all of this added value based on surplus after dividends, a great deal of the surplus being lost through inventory deflation or spent for new construction or acquisitions. Some retained most of their surplus in working capital as in the case of the General Electric Company among these electrical manufacturers.

The complete analysis of working capital in computing this statement showed that corporate purchasing power was never greater than at the beginning of this year. Covering the 141 companies, cash was equal to 60.5 per cent of inventories in 1919, 38.9 per cent in 1920, 50.4 per cent in 1921 and 64.1 per cent in 1922.

In the inventory totals there is an interesting record of the swing of the business cycle through which industry has been passing. It is also interesting to note that during this period central-station capitalization increased 91 per cent against the 195 per cent recorded here for these seven electrical manufacturing companies.

An Experience in Schooling Dealers

Describing an Educational Effort Which Has Produced Remarkable Results and Points an Opportunity to Other Electrical Manufacturers

By George R. Purvis
Assistant to President, Hurley Machine Company, Chicago

THE securing and developing of an efficient personnel among distributors and dealers is, of course, a serious problem with all manufacturers whose product is resold to the public. And this class of product bulks so large now in the electrical industry that I believe a recent experience of this company will be of general interest. It concerns an experiment in the systematic schooling of dealers and their salesmen and some remarkable results that have come out of it.

In the early days of our company, of course, a few of us were able to visit more or less frequently our principal customers. We were able to give general information concerning our line to our local distributors, and we felt that the real work of education could be best distributed to our customers and dealers through letters and data sent out from our home office and factory. As the business expanded, however, and our lines of distribution grew from a handful of dealers into hundreds and then thousands of jobbers, central stations, electrical contractor-dealers and department stores, we began to realize that a systematic educational program must be instituted and followed out if the salesmen on the firing line were to be properly equipped to fight our battle.

Fast Selling Needed

Electric washing machines, ironing machines and vacuum cleaners, while recognized today as almost indispensable to the housewife, and of such common usage as to need but little description, are nevertheless specialties. As such they require salesmen with a trained knowledge that may only be gained through a special source of information.

Hit-or-miss statements regarding the use, cost of operation or comparative efficiency of electric home labor-saving devices destroy the confidence of the housewife and lessen her interest in these appliances. And unless her interest can be aroused there is but scant chance for imbuing her with a desire for them. Trained salesmanship, it was our opinion, would tend to equip salesmen with intimate knowledge of our product, acquaint them with details of its manufacture, familiarize them with the personnel of our organization and give them positive data which they could authoritatively pass on to their customer—the housewife.

We have always been firm believers here in the use of facts in selling. We have kept away from general statements and endeavored to implant in the customer a confidence in our goods and in our institution, and we have found it effective. But naturally the remote dealer, with his scant knowledge and with his uncertain contact with our end of the business, is usually not well equipped to tell this very vital story. After considerable study of the plan, therefore, we decided to make an attempt to bring in a certain number of our dealers or their best salesmen and in so far as possible give to them the history, the viewpoint and the experience of our company and a knowledge of its products. We were confident that enough could be accomplished to make better salesmen of them when they went back home.

We began this school in a very small way. A few salesmen came in to us from our dealers in Michigan, Indiana or Wisconsin towns. To them was given a careful and truthful history of the development of the washing-machine industry. We gave them intimate data of our own very humble beginning and then carried them along through the development of our business until they were brought to realize the tremendous sales possibilities that lay before them. They were taken into our factory from one department to another, and during these trips each process was explained with such care that they became thoroughly familiar with all parts of each product. Our schoolroom was the scene of play sales, play demonstrations, lessons in meter reading, and so on, and was then thrown open to discussions of various topics brought out through our factory trips and sales talks.

We sent them out into the city with the demonstrators and service men of the company. These trips carried them into the homes of users of our appliances, where they saw a washing or ironing done by one of our own experts. Or, in company with one of the service men, they discovered the shortest and quickest way to overcome the difficulty that

the housewife had encountered in the use of any appliance.

One of the most important points to us of this students' course was the information which we were able to gather and retain concerning our guests. We filed and indexed this information. It gave us a history of each man.

Of course, it must be realized that these students of ours were our guests and in every instance also our customers, and throughout the few days of training our thought was not only to teach these young men about our products, how to sell and how to make themselves liked, but also to make them like us. Therefore, we all were enthusiastic and intensely interested in each other's success and helpful to each other wherever possible, and in this atmosphere a strong human bond quickly developed.

Influence on Sales

When 250 of these students had visited us, each one our guest for a period rarely less than three days, we took stock of the work we had done. We were anxious to discover to what degree this training had benefited those men who had visited us. Here came the surprising fact. The *average* amount of sales personally made by these guests of ours over a two months' period following their visit, as compared with their sales for the two months prior to their visit, showed a surprisingly large increase.

Thus was laid the foundation for our later development—which we have called the "Hurley School of Salesmanship"—by which it is our plan to put into the electrical merchandising field not less than two thousand trained salesmen—men who will be thoroughly equipped to sell electrical home labor-saving devices to the housewife. We sent out an announcement of this plan to educate the salesmen of electrical dealers and central stations to all of our dealers, and their responses were immediate. The price is $37.50, but when the applicant is recommended by an official of this company he has the opportunity to enroll without cost. The course comprises eight lessons or books, sent out successively, and in each instance the prompt return of a questionnaire made up from the text of the lesson inclosed is required.

We have been literally overwhelmed with applications. Within the last four months more than twenty-five hundred men have asked to be enrolled in this course of training, and we are taking all of them as fast as we can meet the demands.

It has not been our thought to develop and make electrical experts of our students, but rather to place within their reach obviously simple, common-sense truths about the sale of electrical merchandise. It has been our one aim to develop in each student the capacity to analyze himself and to be able to solve properly his customer's problem. We believe that this offers a means whereby any manufacturer whose product must be resold at retail may build up a distributing organization more efficient than has ever been possible before. Undoubtedly, it will result in a tremendous benefit to the electrical market. It is an activity that, we believe, should be considered seriously by every appliance manufacturer.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

THE week has been generally characterized as dull by the electrical trade throughout the country—with a falling market. Brass and copper have dropped in New England and sockets have followed. A reduction in glassware became effective widely. A sweeping cut in wire, including rubber-covered and leaded conductors and cords, was reported from Chicago. Cautious buying and keen competition for orders are increasing on the Coast. However, it is almost universal opinion that business merely waits on the opening of the normal fall activity and that prospects are good.

There is undoubtedly a slowing down in building construction. Large power developments in the Pacific States have also slackened, but there is an expectation that railroad and industrial buying will be an important element in the market before long. Stocks are reported low and collections a bit tardy.

Better Volume But Disappointing Profit on Safety Switches

WITH sales of safety switches in July approximately 30 per cent greater than in January, the present business of the majority of manufacturers of these articles is considerably ahead of any six-month period in two years. Deliveries generally are somewhat retarded on account of the advances in connection with raw materials and shortages in the labor market. Prices have not changed recently, although the tendency of switches is toward a slight increase in the higher grades and considerable increases in the cheaper grades, as raw-material costs make up a greater proportion in the cheaper switches than they do in the higher-grade switches.

Manufacturers doubt very much if there will be any material decline in demand for safety switches, but at the same time do not expect any large increase in orders outside of the normal expansion due to safety education and legislation in that direction. Of the two fields, domestic and industrial, the domestic field is showing the bigger increase in orders. This field usually represents the lower-priced and simpler type of switch, such as may be required and suitable for residences, apartments and other places where severe conditions do not exist, in so far as continuous operation of the switch is concerned. Competitive pressure is usually much worse, however, because the same discrimination is not used in buying in this field that is used in the industrial field, because the general public does not understand installation conditions, and also probably because most of this material is bought on a bidding basis. It is the opinion of the manufacturers that a great many switches made for the domestic field are being sold at less than cost so far as the manufacturers are concerned, because there is a constant addition to the number of firms going into this field.

Elimination and standardization are becoming more and more necessary in this industry. The wide number of varieties, styles and duplications cut into quantity production and the customer does not get the benefits which would ensue if fewer styles and types were made, with lower costs on the part of the manufacturer. One important standardization affecting four leading manufacturers is announced on page 515.

Currency Status Now Working to Help American Exporters

IN SPITE of the fact that recent reports on exports of electrical material from this country have shown that business is falling off somewhat, the outlook in the foreign market generally is exceedingly promising in the opinion of a prominent New York export agent. This man maintains a specialized organization and represents about a dozen important manufacturers of electrical commodities, carrying on their sales in the foreign fields.

The basis of his optimism is the fact that throughout South America, in Australia, the Orient and generally about the world, American money has for three years or more appreciated.

This means depreciated local currency for the foreign merchants as applied to

imports from the United States. It has continued so long, however, that importers are becoming accustomed to it and adjusting themselves to the idea of buying from us on a rising market. Orders for American goods continue small in the main and spotty, but they are emanating from many odd corners where business is not expected, and from many other sections, where the American manufacturer naturally would look for orders, they are slow in materializing. All in all, however, this increasing activity indicates a better state of mind toward buying from this country, be the price what it may, because of American standards of quality and the ingenuity displayed in many of our products. It would seem to indicate that the manufacturer who will patiently develop these foreign contacts will be able to build up a very substantial export business that will continue as a distinct asset.

European business naturally waits upon the settlement of the French-German tangle, but in the opinion of many this works to the advantage of the American manufacturer rather than against his interests. Just so long as Europe remains unsettled and Germany in doubt as to her economic position, so long is there restraint upon German exporting activity, and the flood of German goods which will unquestionably follow a final adjustment of German debts is held back from our market. This gives more time to American manufacturers to establish themselves in foreign markets before the price competition of German goods begins to put pressure upon them.

Interesting Trends in Elevator Control Equipment—Sales 40 per Cent Better

UP TO July 1 manufacturers of elevator equipment have been enjoying a particularly gratifying volume of business, about 40 per cent better than the sales of 1922. The biggest single source of business has been the apartment house, the small hotel, the small office building and the department store. The biggest profit, however, comes from the large office buildings with installations of twenty to forty high-speed elevators.

The general business outlook in this field is considered very good. It is estimated that the country is underbuilt by several years on the type of building that requires elevators, and as conditions continue to settle down the market will be increasingly strong. No large immediate business is expected from the East as building is quiet. Buying on the Pacific Coast has been exceptionally heavy. Sales have been very active in Detroit, fair in Chicago, and in St. Louis not so good.

The interesting trend in the field of elevator equipment right now is the progress that is being made toward the development of high-speed and heavy-duty units with reduction in energy consumption. One of the leading manufacturers has developed a patented micro-drive control that automatically levels the floor of the elevator and is making possible important economies. This is actually a war product, for the micro-drive elevator was originally devised to make possible the laying of the North Sea mine field. The British government attempted to lay these mines, but was unsuccessful owing to inability to regulate the level of the mine accurately.

It was the possession of this machine—for it is not a device, but a complete machine—that made it possible for the American fleet to do the job. In its application to the passenger and freight elevator it brings distinct advantages, for to stop an elevator and then adjust it to within an inch of floor level consumes as much energy as to raise it to the next floor. On freight elevators this automatic control is so sensitive that as an industrial truck is driven onto the elevator the level of the floor is adjusted to the increased weight, taking all the shock off the truck.

In passenger service speed is steadily increasing in the large building installations. In the Woolworth Building elevators operate at 700 ft. per minute. The new Standard Oil Building will have service at 800 ft. a minute. Probably elevator speed will before long increase to 1,000 ft. a minute. It is all a matter of control. Apparently push-button control of elevators is soon to be carried much further than has been generally expected. This system is becoming standard in small apartments, homes, banks and so forth and is now being adapted for large industrial purposes. At the army base in Brooklyn ninety-six elevators are operated from a single switchboard by a car dispatcher. As an industrial truck or train approaches, this dispatcher signals the elevator which it is to board and controls the elevation of the load from his seat. It is estimated that this system of control is saving $96,000 a year in this one great warehouse.

In short, the elevator manufacturer's problem today is largely one of control, and he sells to a market that no longer has to be educated as to the need for elevators. The electric elevator has become standard throughout the country, and the selling process resolves itself into a matter of competition between systems, which is being maintained on a very high plane with a relatively small price pressure.

Business Quiet in the Northeast with Drop in Glass and Sockets

ELECTRICAL trade reports from the Northeast as August closed voiced general confidence in the outlook for fall business and in some lines recent orders indicate a desire to take advantage of present delivery conditions. Leading Boston jobbers announced a new schedule of prices last week on sockets in lots of 1,000, amounting to reductions of from 1 cent to 1.5 cents net according to type. Copper and brass prices reflect weakness. The only prospect of scarcity in stocks lies at present with rigid conduit, although deliveries of motor-control apparatus are lengthening as the demand for these products increases. On the whole, seasonal dullness marked last month in New England and New York, although in exceptional cases the volume of trade ran ahead of July's. New England textile mills and paper plants are resuming larger-scale operations. Retail trade is good, although electric appliance sales are expected to increase rapidly from now on. Electric ranges are moving better, and motor-operated refrigerating plant builders note increased interest in their products. Electric sign business is improving. A general reduction was made in a leading glassware line to meet competition, despite the fact that costs have not come down. Interest in electric industrial truck service is showing new life. Preholiday quiet prevailed over the week end.

Sweeping Revision Downward of Wire Prices in Chicago—Business Quiet

GENERAL business in the electrical trade in the Chicago district as a whole has not improved this week. In fact, it may be considered a little duller than last week. Pole-line hardware sales have not been so good as in the earlier part of the month. Stocks of poles are still short on many sizes and prices are firm.

The most important price change this week is a general revision in the prices of wire, effective Aug. 25. Rubber-covered code wire dropped approximately 5 to 10 per cent. Leaded conductors dropped approximately 7 to 10 per cent. Cotton lamp cord dropped approximately 10 per cent, while type P and reinforced cords dropped approximately 13 per cent. It is not the opinion of the trade that this condition will exist for a long period. No. 14 S.C.S.B. solid at $6.52 Chicago is a rather low price, and indications are that an upward revision of wire prices about the fifteenth of this month may be expected. Contrasting with the drop in code wire, flexible armored cable officially advanced to $42 Pittsburgh.

The steel trade announces that steel advanced 18 cents per 100 lb. While this advance is only on heavy beams and structural shapes, it may be an indication that there will be a general advance in steel, which would cause the price of conduit to advance with the price of merchant pipe.

Stocks Low in St. Louis, but Sales 40 per Cent More than Last Year

ELECTRICAL business in St. Louis has picked up considerably during the past month. Jobbers report that the volume of sales exceeded that of the corresponding month last year by about 40 per cent. There have been no important changes in prices with the exception of a slight reduction in the price of wire early in the month. Stocks are in fair condition. Jobbers say that

they are keeping stocks as low as is consistent with the present volume of business. Labor troubles have retarded the sales in some lines of contractors' supplies. Some slowing down is noted in the demand for ornamental lamps and fixtures. Revival of interest in radio is becoming quite apparent as is consistent with this time of year.

Collections indicate a slowing down compared with the recent months, wholesale dealers report backwardness on the part of retail dealers in the wheat section, and the coal-mining section is not so active as it has been during the same month in previous years. Following several months of marked activity, the commercial paper market during the last thirty days showed a very decided slump and the volume of bank credits in use has shown a considerable reduction.

Cleaner and Range Sales Increase in Southeast—Retail Business Good

ALL jobbers report a satisfactory business, considering the summer lull, with a slight pick-up to be noticed. The outlook for the fall is very good. General stocks are in fair condition and deliveries are reasonably satisfactory, except on copper wire—these ranging from stock shipments on certain sizes to three to four months on others. The movement of conduit is excellent, and jobbers are having no trouble meeting the demand, satisfactory stocks and regular deliveries being reported for this section.

Electrical contractors report a slight slowing up. Prospects are good, however, for the remainder of the year. The Southeastern manager for one of the largest vacuum-cleaner companies reports sales as double those of the same period of last year and the sales forces have been considerably augmented. The outlook for this line is better than for three years past. Dealers report a very satisfactory movement in batteries, particularly of the automobile type. Deliveries on this class of battery are lengthening.

The volume of sales of the popular-sized meters is reported quite satisfactory with the proportion of the 10-amp. size on the increase. Electric range sales by utilities have increased the sales of the 25, 50 and 75-amp. meters from 200 to 300 per cent. Retail business in general is very good for the season of the year, particularly the lighting-fixture line. Electric sign sales are going well, though business is mostly in the small-size store signs. Central-station expansion continues.

Increased Industrial Market on the Coast — Large Railroad Business in Sight

THE falling market for electrical commodities on the Pacific Coast has continued through this week and served to intensify the exceedingly keen competition that has prevailed throughout the year. Cautious buying is the rule. Major power construction has temporarily slackened in northern California, and power company purchases are now mainly for extensions and applications. Industrial business is good, however, and as the effect of the long-predicted decline of building becomes more apparent, it is possible that the industrial field will become the battleground for fall business. Building permits in San Francisco for August totaled $3,915,300, as compared with $6,214,082 for August, 1922. The last year's figures, however, include several very large buildings, and notwithstanding the apparent discrepancy, building is really holding up pretty well. There was, in fact, a 10 per cent increase in the number of jobs over August a year ago.

Retail business is fair. There is promise of a very large radio activity and the general expectation is that the season will be excellent. The neighborhood store seems to hold its own. Collections show a rather discouraging rate of improvement, but fruit and crop receipts circulating through all channels will generally help the situation. The Southern Pacific Railroad Company has announced an expenditure of $40,000,000 actual or impending for new equipment and in addition a projected expenditure of $50,000,000 for new trackage and yardage. It is possible therefore that railroad business may occupy the same dominant position in the markets of 1924 and 1925 that power business has occupied for the four or five years just passed.

The Metal Market

A GENERAL improvement in the metal market has been recorded this week, largely a reaction from a stiffening of prices in London due in part undoubtedly to the war scare, which naturally suggests heavy buying for munitions. Copper fell off and then recovered following the London rally and is much firmer at 13⅞c. Lead is strong with a varied demand from manufacturers of paint, batteries, etc. Zinc has also improved largely on a demand from galvanizers, who are seeking sheet metals for Japan. The general feeling is confident.

NEW YORK METAL MARKET PRICES

	Aug. 29, 1923 Cents per Pound	Sept. 5, 1923 Cents per Pound
Copper, electrolytic	14.00	13.75
Lead, Am. S. & R. price	6.75	6.75
Antimony	7.55	7.60
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.90	6.55
Tin, Straits	40.75	43.00
Aluminum, 98 to 99 per cent	25.00	25.00

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Wetmore-Savage Sales Meeting Keyed to Hard-Working Fall Program

Thirty-five members and guests affiliated with the Wetmore-Savage Company, electrical supply jobbers, Boston, held a two-day semi-annual sales conference recently at the Exchange Club in that city under the chairmanship of Karl L. Norris, head of the appliance department at the main offices. The program included addresses by ten representatives of manufacturing organizations for which this company is a distributor. The general tone of the conference was favorable to excellent business this fall predicated on vigorous and sustained sales effort.

Walker Vehicle Opens a New Orleans Office

The Walker Vehicle Company, manufacturer of Walker electric trucks, with general offices and factory in Chicago, has opened a branch office and service station at 314 St. Joseph Street, New Orleans. Thomas H. Shields, formerly a dealer for the Walker Vehicle Company, has been appointed manager. The increasing importance of the southern part of the United States as regards transportation needs in cities is given as the reason for opening this branch as well as for the establishment previously of a branch office at Atlanta. Among recent installations of Walker electric trucks in the South is that of twenty-five Walkers recently put in the service of the American Railway Express Company in San Antonio, Tex.

W. N. Matthews Corporation Announces Changes in Territorial Representatives

The W. N. Matthews Corporation of St. Louis has recently announced certain changes in the territories covered by its various representatives. W. J. McIlvane, 30 Church Street, New York City, whose territory has consisted of the southern half of Connecticut, all the State of New York and the eastern half of New Jersey, will also look after the eastern half of Pennsylvania, the State of Delaware and the District of Columbia. H. G. Biglin, 41 Fairlie Street, Atlanta, and his organization will represent this company in Virginia, North and South Carolina, Georgia, Florida, Mississippi, Louisiana, the eastern half of Tennessee, and the southern half of Arkansas. These changes were brought about by the resignation of George C. Young, who has been a representative of this company for years with offices in Philadelphia.

W. M. Watters, 1319 Main Street, Kansas City, Mo., whose territory has consisted of the western half of Illinois south of Peoria and the States of Iowa, Missouri, Nebraska, Kansas and Oklahoma, will also have the northern half of Arkansas and the western half of Tennessee.

A New Chicago Distributor

B. J. Mockenhaupt & Company, 217 North Desplaines Street, Chicago, has recently been organized to conduct a sales and service business for electrical manufacturers, and has been appointed district sales representative for the Dayton Fan & Motor Company of Dayton, manufacturer of radio parts, fans and motors. Mr. Mockenhaupt was formerly vice-president of the Electrical Materials Company of Chicago, having had twenty years' experience in the electrical sales and jobbing business in this territory. This new organization is desirous of representing two or three other manufacturers of various electrical equipment.

Glassware Guild Makes a Survey

For the purpose of demonstrating the tremendous market for illuminating glassware that exists in the United States today, the Illuminating Glassware Guild of Cleveland has recently made a survey of conditions in homes and published statistics on the national market. Then, to crystallize the opportunity, it has made an intensive study of what this means in terms of the local market in Jasper, Ind., a community of 2,359 inhabitants. The figures are as shown in the table.

The Glassware Guild suggests, as a practical method of calculating the market for glassware in a town, that the number of wired homes in a community be multiplied by eleven. The result represents the possible sales of glass shades within the community for the next period of twelve months.

THE NATIONAL MARKET	
Wired homes in the United States	9,676,330
Total number of sockets	181,874,000
One half of these sockets need glass	90,937,000
Estimated number of homes to be wired by the end of 1923	1,231,000
Additional sockets to be shaded by glass	27,082,000
Total potential market for residential lighting glassware, end of 1923	118,196,000
THE LOCAL MARKET	
Population of Jasper, Ind.	2,359
Number of electrical dealers in Jasper	2
Number of homes	564
Number of wired homes	500
Number of sockets	11,000
Number of sockets requiring glass shades	5,500
Possible sales of residential lighting glassware per dealer, not counting homes wired in 1923	2,750

Nela Park Offers Undergraduate Lighting Course

The first annual course in "the lighting business" was given at Nela Park, Cleveland, from Aug. 20 to Sept. 1, under the direction of the engineering department of the National Lamp Works. This course was designed to give university undergraduates an opportunity to look into this phase of the electrical industry before they became permanently tied up with any of the other branches. While at Cleveland the men, numbering about thirty of the junior class, were guests of the company, all their expenses being paid. Some of the subjects offered in this course were as follows: "Large lamp manufacture," "civilization and light," "demonstration of lighting fundamentals," "light and production," "general lighting for industrial operations," "light and living," light control" and "principles and applications." All these subjects were presented by engineers of the organization.

Johns Pratt, Square D, Trumbull and Westinghouse Standardize on Service Entrance Safety Switch

AN IMPORTANT contribution to standardization appears in the announcement that four prominent manufacturing companies in the safety-switch field, the Johns Pratt Company, the Square D Company, the Trumbull Electric Manufacturing Company and the Westinghouse Electric & Manufacturing Company, are going to manufacture a radically new service-entrance unit which combines all the functions necessary for complete service connection and distribution. This announcement was made by the Johns Pratt Company, Hartford, Conn., licensor of the device.

It is the belief of these manufacturers that the combination in a single compact safety switch of the features now provided only in several separate units offers opportunity for a distinct economy in manufacture as well as in installation practice. In addition they point out that this simple and standardized unit should also make for uniformity of practice, whether the installations are made by the central station, the contractor or the consumer.

It is the opinion of these manufacturers that the uniformity of their combined production on this single device will have a far-reaching influence on the promotion of the idea of standardization and provide a conspicuous example of what may be accomplished by the practical application of this economic principle.

Cleveland League Opens Another Electrical Home

The sixth electrical home to be established under the auspices of the Electrical League of Cleveland opened Aug. 19 and will be kept on exhibition for a period of one month. The home is at 2543 Euclid Heights Boulevard and is a nine-room brick structure with a two-car garage.

A special advertising campaign to sell the idea of more and better lighting equipment in homes is to be run in the daily papers during the exhibit. Under the league's lighting section committee a concerted drive is being made to improve store lighting in Cleveland. An illustrated folder dealing with this subject is being mailed to five thousand Cleveland merchants.

The Crocker-Wheeler Company, Ampere, N. J., manufacturer of electrical machinery, will soon build a one-story addition to its power house.

The Crown Rheostat & Supply Company, 35 South Desplaines Street, Chicago, is having plans prepared for a two-story building, 50 ft. x 72 ft., at 1908 Park Avenue, to cost $28,000.

The Reynolds Electric Company, 2650 West Congress Street, Chicago, manufacturer of electrical equipment, will build a one-story addition, 50 ft. x 75 ft.

The International General Electric Company, 120 Broadway, New York City, has taken a contract from the Paulista Railway, Brazil, for the electrification of 38 miles of line at a cost of $1,000,000, including equipment, completing the system from Tatu to Jundiahy, approximately 63 miles.

The Fibre Conduit Company, Orangeburg, N. Y., manufacturer of insulating conduits, etc., has awarded a general contract for the first unit of its new plant at Richmond, Ind., to cost $400,000 with machinery. S. R. Bradley is president of the company.

The Standard Underground Cable Company, Westinghouse Building, Pittsburgh, has awarded a general contract for a new two-story plant, 125 ft. x 300 ft., at Emeryville, Cal., to cost $200,000.

The Evergreen Electric Appliance Company, 411 Central Building, Seattle, Wash., which has acquired the Bestov Appliance Company, has established a factory and expects to be ready for operating in a few weeks. Frank MacKean is president.

The Western Electric Company has acquired a twenty-five-acre site at East Nashville, Tenn., where it plans to build a factory for the manufacture of electrical equipment.

The Crouse-Hinds Company, Syracuse, N. Y., manufacturer of electric wiring equipment, is preparing plans for a new one-and-two-story building at its Toronto works, estimated to cost $150,000.

The Rome Wire Company, Clyde Avenue, Buffalo, manufacturer of wire, cable, etc., has purchased a block of property in the vicinity of its works, totaling over four acres, and will use it for expansion. Plans for the first building have been arranged.

Portus Baxter, Jr., has joined the Western sales force of the National X-Ray Reflector Company, with headquarters at Los Angeles. Mr. Baxter will confine his efforts at present to the Southern territory, under the direction of F. S. Mills, Western district manager for the company.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Amsterdam, Netherlands (No. 7,576), for electrical appliances.

Purchase is desired in Turin, Italy (No. 7,582), of electrical equipment, etc.

Purchase and agency is desired in Rotterdam, Netherlands (No. 7,649), for electrical goods and small patented novelties.

Purchase is desired in Algiers, Algeria (No. 7,613), of ice-manufacturing machinery.

An agency is desired in Turin, Italy (No. 7,606), for ice-manufacturing and refrigerating plants.

An agency is desired in Antwerp, Belgium (No. 7,577), for industrial motors.

ELECTRIFICATION OF RAILROAD IN VENEZUELA PROPOSED.—The electrification of the Ferrocarril de La Guaira Railway, which connects the port of La Guaira with Caracas, Venezuela, *Commerce Reports* states, is under consideration.

AUTOMATIC TELEPHONES IN SOUTH AFRICA.—Automatic telephone exchanges, *Commerce Reports* states, will soon be installed at Port Elizabeth and Pietermaritzburg, South Africa. It is proposed to extend the automatic system throughout the country as existing plants require replacement.

New Apparatus and Publications

LIGHTING DATA.—The Edison Lamp Works of General Electric Company, Harrison, N. J., are distributing bulletins L.D. 118A, L.D. 145, L.D. 146, entitled "The Incandescent Lamp—Its History," "The Lighting of Theaters and Auditoriums" and "Stage Lighting" respectively.

MANUAL AUTOMATIC COMPENSATOR.—The Electric Controller & Manufacturing Company, 2700 East Seventy-ninth Street, Cleveland, has developed the new type "ZK" manual automatic compensator, which is an entirely new method of starting alternating-current motors.

LIGHTING FIXTURES.—The McPhilben Lighting Fixture Company, Queens, N. Y., has published a sixty-four-page catalog which describes and illustrates the various types of its "Queens" quality line of residential lighting fixtures.

VOLTAGE RELAYS.—Bulletin No. 47,635 issued by the General Electric Company, Schenectady, N. Y., covers its type PQ-25 and type PQ-26 under-voltage relays.

ADJUSTABLE-SPEED MOTOR.—The Reliance Electric & Engineering Company, Ivanhoe Road, Cleveland, is distributing bulletin No. 1,014, describing its type "AS" Reliance adjustable-speed motors of the armature-shifting design.

MULTIPLE-CONTACT AUXILIARY RELAYS.—Two types of auxiliary relays are manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., type "M" for intermittent duty on direct-current circuits and type "MC" for continuous duty on both alternating-current and direct-current circuits.

INTERNAL-COMBUSTION ENGINES.—The Worthington Pump & Machinery Corporation, 115 Broadway, New York City, is distributing a booklet containing a reprint of an address to the New Waterworks Association on the application of internal-combustion engines to waterworks service.

CLOTHES DRIER.—The Bock Laundry Machine Company, Toledo, Ohio, is distributing a folder describing the new "Bock" electric clothes drier.

ELECTRIC STOVE.—Two electric stoves, lamp-socket models, known as the "Ever-Hot," are being manufactured by the Toledo (Ohio) Cooker Company, the one-burner model has a detachable handle, while the two-burner plate handles are stationary.

WATER FILTERS.—The Graver Corporation, East Chicago, Ind., is distributing bulletin No. 501, describing its horizontal pressure-type water filters.

ELECTRIC CONDUCTION HEATERS.—Publication No. 3,062 issued by the Cutler-Hammer Manufacturing Company, Milwaukee, describes and illustrates its electric conduction heaters for general industrial and machine applications.

EXHAUSTERS, VENTILATING FANS, BLOWERS, ETC.—The American Blower Company, Detroit, has issued a new general catalog covering its products, including exhausters, ventilating fans, air washers, blowers, engines, etc. The company is also distributing a folder entitled "Putting New Life Into Dead Steam," which calls attention to the use of its "Detroit" return systems in power and heating plants.

ELECTRIC TOASTER.—Landers, Frary & Clark, New Britain, Conn., are distributing a folder covering their "Universal" oven toaster.

ARC-CURRENT-WELDING TRANSFORMER.—The Waters Arc Welding Corporation, 619 Tenth Avenue, New York City, has brought out an arc-current-welding transformer.

TRANSFORMER INSTALLATIONS.—Bulletin No. 2,020 issued by the Pittsburgh Transformer Company, Pittsburgh, contains illustrations of installations of "Pittsburgh" transformers on lines of various public utilities, steel mills, coal mines and industrial plants throughout the United States.

New Incorporations

THE ST. CHARLES (KY.) ELECTRIC LIGHT & POWER COMPANY has been incorporated by W. L. Morse, H. E. Kinnett and others.

THE FORD HYDRO ELECTRIC COMPANY, Madison, Wis., has been organized with a capital stock of $25,000 to develop water rights, electric light and power plants and to generate and distribute electricity. The company is not a public utility. The incorporators are William Ryan, Arnold Peterson and Alfred T. Flint, all of Madison.

THE BETTENDORF (IOWA) LIGHT & POWER COMPANY has been incorporated by J. W. Bettendorf, E. J. Bettendorf, Henry Bellinghausen, J. H. Bendixen and W. J. Schneider. The company is capitalized at $100,000 and proposes to generate and distribute electricity in Bettendorf.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

SUNAPEE, N. H.—The Lake Sunapee Power Company will soon begin work on the construction a power plant to cost about $50,000. Charles T. Main, 200 Devonshire Street, Boston, is engineer.

BOSTON, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 26 for changes in lighting and ventilating systems in the United States Post Office and Subtreasury, Boston. For details see Searchlight Section.

DEDHAM, MASS.—The Dedham & Hyde Park Gas & Electric Lighting Company has received permission to issue $48,455 in capital stock, the proceeds to be used for extensions.

LEOMINSTER, MASS.—Contract has been awarded by the Leominster Electric Light & Power Company for the construction of a new substation in North Leominster, to cost about $30,000.

ROCKY HILL, CONN.—The Belamose Corporation, 303 Fifth Avenue, New York, plans to build a power house at its proposed local artificial silk plant, to cost about $450,000.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 11, for fire-tube boiler and electric wire and cable, Navy Yard, Brooklyn.

BROOKLYN, N. Y.—Bids will be received by the Quartermaster Supply Office, G. I. depot, First Avenue and Fifty-eighth Street, until Sept. 12 for twenty-six single-phase, 110-volt, 10-amp. electric meters, and for thirty single-phase, 110-volt meters. (Circular 24-33.)

BROOKLYN, N. Y.—Electric equipment, conveying machinery, etc., will be installed in the new distributing plant to be erected on Third Avenue by the Borden Farm Products Company, 110 Hudson Street, New York City, to cost about $350,000.

CHURCHVILLE, N. Y.—Electrically operated pumping machinery will be installed at the municipal waterworks in connection with extensions, to cost $80,000. R. E. Gaskin, Cutler Building, Rochester, is engineer.

JAMESTOWN, N. Y.—Electrically operated pumping machinery will be installed at the municipal waterworks in connection with extensions, to cost about $280,000.

MEDINA, N. Y.—The Western New York Utilities, Inc., has been granted permission to serve electricity in Pavilion Township, under a franchise granted by the Town Board. The company was also authorized to erect and operate a transmission line across the Tonawanda Reservation, in Alabama Township.

RICHMOND, N. Y.—The Staten Island Edison Company, successor to the Richmond Light & Railroad Company, has issued $3,807,000 in bonds, part of the proceeds to be used for extensions and improvements.

WARREN, N. Y.—The Southern New York Power Corporation, Coopertown, has been granted permission to supply electricity in the town of Warren.

JERSEY CITY, N. J.—Electric power equipment will be installed in the proposed addition to the plant of the Continental Can Company, Fifteenth and Sixteenth Streets, to cost $500,000. Francisco & Jacobus, 511 Fifth Avenue, New York, are consulting engineers.

KEARNY, N. J.—The Western Electric Company, 195 Broadway, New York, is preparing plans for the construction of a power house at its new local works, to cost about $150,000.

TRENTON, N. J.—Electric power equipment will be installed in the proposed addition to the plant of the Hamilton Rubber Manufacturing Company, to cost about $80,000.

TRENTON, N. J.—Plans have been completed by the John A. Roebling's Sons Company for the erection of a power house at its wire works on Clinton Avenue.

ATWOOD, PA.—The Atwood Borough Electric Company and the Dayton Borough Electric Company, recently organized, plan to erect transmission lines. The companies are represented by McCahill, McCahill & Tabor, 908 West Penn Building, Pittsburgh.

BRISTOL, PA.—The Rohm & Haas Company contemplates building a power house at its chemical manufacturing plant.

CHESWICK, PA.—The Peerless Sand Company, Oliver Building, Pittsburgh, will install electric power equipment in connection with the rebuilding of its local plant, recently destroyed by fire with loss of about $90,000.

HUNTINGDON, PA.—The Penn Central Light & Power Company, Altoona, has acquired the properties of the Raystown Water Power Company, including a hydro-electric station on the Juniata River.

JOHNSTOWN, PA.—The Clarion River Power Company is perfecting plans for the construction of the first of a series of hydro-electric power plants at the Piney dam.

LYKENS, PA.—The American Briquet Company, Land Title Building, Philadelphia, plans to build a power house at its proposed fuel-briquet manufacturing plant, to cost about $350,000.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company plans extensions to its substation at Thirteenth and Mount Vernon Streets, to cost about $27,000.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company plans to build a mechanical and repair shop at Constitution and Monument Streets, to cost about $75,000.

HAGERSTOWN, MD.—The Potomac Transmission Company, Wingert Building, will have charge of the distribution of electricity generated at the plant of the Potomac Edison Company in Williamsport. The West Virginia Transmission Company will be incorporated to handle the distribution in West Virginia.

WILLIAMSON, W. VA.—The Thacker Coal & Coke Company, Cincinnati, is planning to install electric power and mechanical equipment at its local properties. An appropriation of $500,000 has been arranged.

CHARLOTTESVILLE, VA.—Contract has been awarded by the Virginia-Western

Power Company, Clifton Forge, to Francis R. Weller, contractor, Mills Building, for the construction of the proposed double-circuit, steel-tower, 110,000-volt transmission line between Charlottesville and Staunton.

NORFOLK, VA.—The Virginian Railway Company plans to build a 90,000-hp. power plant on the New River in connection with the electrification of its line from Roanoke, Va., to Mullins, W. Va., 213 miles. A number of substations will also be built.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Sept. 11 for three transformers. (Schedule 1265.)

WASHINGTON, D. C.—Bids will be received by the Quartermaster, United States Marine Corps, until Sept. 11 for switches, fuses, switch boxes, electric cable, wire strand, clamps, plugs and one regulator. (Schedule 112.)

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until Sept. 20 for electric motor, electric hoists and other electrical and mechanical equipment. (Circular 1555.)

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, Munitions Building, until Sept. 10 for 250 single-pole, double-throw toggle switches; 250 single-pole, double-toggle switch guard plates, and 250 flush tumbler switches and plates, 3-amp. (Circular Q.R. 2416.)

North Central States

BEVERLY, MICH.—The Certain-Teed Products Corporation will install electric power equipment in connection with additions to its local plant, to cost about $250,000.

BIG RAPIDS, MICH.—Plans are under consideration by the Big Rapids Electric Company for the installation of new equipment at its hydro-electric plant. Burd & Giffels, Powers Theater Building, Grand Rapids, are engineers.

ITHACA, MICH.—The Council is considering the installation of deep-well pumping machinery at the waterworks plant. Burd & Giffels, Powers Theater Building, are engineers.

LANSING, MICH.—The State Highway Department contemplates the construction of a power house in connection with the proposed state-owned cement plant.

CINCINNATI, OHIO.—The construction of a telephone exchange at Harrison and Epworth Avenue, to cost about $250,000, is under consideration by the Cincinnati & Suburban Bell Telephone Company.

CLEVELAND, OHIO.—Bids will be received by the Commissioner of Purchases and Supplies, City Hall, until Sept. 14 for fiber conduit for the Division of Light and Power.

CLEVELAND, OHIO.—The Council is considering calling an election to submit the proposal to issue $3,000,000 in bonds for extensions to the municipal electric plant at East Forty-third Street or to build a new plant on the West Side near the Division Street pumping station.

CLEVELAND, OHIO.—Separate bids will be received by the Commissioner of Purchases and Supplies until Sept. 14 as follows: Material for and construction of an underground system for steam supply and return, and also for a conduit system for electric wires between the present tunnel and new administration building of the children's tuberculosis unit at Warrensville; also for installing 2,200-volt lead-covered cables from pole at tunnel to transformer vault in new administration building of children's tuberculosis unit, Warrensville.

DAYTON, OHIO.—The McCall Publishing Company, 236 West Thirty-seventh Street, New York, will build a power house at its new local publishing plant on Kinnison Avenue, to cost about $500,000. Lockwood, Greene & Company, 101 Park Avenue, New York, are engineers.

ELYRIA, OHIO.—A new company, known as the Columbia-Elyria Power Company, has been organized by the Elyria Iron & Steel Company and the Columbia Steel Company, to construct and operate a power plant to supply power to the two steel companies. H. B. Wicks is president of the power company.

TOLEDO, OHIO.—The De Vilbiss Manufacturing Company will build a power house at its spraying equipment manufacturing plant, to cost about $27,000.

BROWNSVILLE, KY.—The Natural Rock Asphalt Company, recently organized, contemplates the construction of a power house in connection with a new plant in Edmondson County, to cost about $175,000.

WOODBURN, KY.—The Kentucky Utilities Company has acquired the local electric plant and similar properties at Auburn and London. The systems will be consolidated and extended and additional equipment installed.

BLUFFTON, IND.—Plans are being considered for the installation of electrically operated pumping machinery in connection with extensions to the municipal waterworks. J. W. Moore, Indiana Pythian Building, is engineer.

INDIANAPOLIS, IND.—The Indiana Electric Corporation has issued $2,700,000 in bonds, part of the proceeds to be used for extensions, including the completion of its proposed generating plant on the Wabash River, with transmission system to the coalfields section. The plant will have an initial output of 40,000 kw.

MUNCIE, IND.—Plans are being prepared by the board of trustees of the Indiana State Normal School for the construction of a power house, to cost about $60,000. Kibele & Garrard, Johnson Building, are architects.

WEST LAFAYETTE, IND.—Bids will soon be asked by the board of trustees, Purdue University, for the erection of an electrical equipment and instruction building, to cost about $100,000. Nicol, Scholer & Hoffman, 308 Main Street, Lafayette, are architects.

CHICAGO, ILL.—Electric power equipment will be installed in the new plant to be erected at Wood Street and Fifteenth Place by the Goss Printing Press Company, 1535 South Paulina Street, to cost about $260,000. R. G. Schmidt & Company, 7 West Washington Street, are architects.

DECATUR, ILL.—Electric power equipment will be installed in the proposed ice-manufacturing plant to be erected by the Polar Wave Ice & Fuel Company, 3626 Olive Street, St. Louis, to cost about $180,000.

CALVARY, WIS.—The installation of an electric lighting system has been authorized by the voters. Electricity to operate the proposed system will be furnished by the Badger Public Service, Plymouth.

COLBY, WIS.—The property of the Midland Public Service Company has been purchased by the Northern States Power Company, Chicago. A transmission line, it is understood, will be erected to connect the local plant with the transmission system of the Northern States company.

EUREKA, WIS.—The installation of an electric lighting system is under consideration.

FOND DU LAC, WIS.—Plans for improvements to the St. Agnes Hospital include the installation of additional generating units in the present power plant and the construction of a new power house of sufficient size to provide for future extensions to the hospital.

HONEY CREEK, WIS.—The plant and holdings of the Honey Creek Electric Light Company have been acquired by the Milwaukee Electric Railway Company. Extensions and improvements are contemplated to the system and connection made with its transmission line at Burlington.

LANCASTER, WIS.—The Council is considering the erection of a transmission line to Shreiner Park and to the city rock quarry, electricity to be furnished by the Interstate Light & Power Company. The installation of a lighting system in Shreiner Park is also under consideration by the Council.

MADISON, WIS.—Bids will be received by Mead & Seastone, Journal Building, Madison, until Sept. 15 for equipment, including power transformers, switchboards, supervisory controls and auxiliary equipment for the new hydro-electric plant being erected at Chaldron Falls, Peshtigo River, near Ellis Junction, by the North East Power Company.

MARSHFIELD, WIS.—At a special election held recently the proposal to install a street-lighting system in the villages of Calvary and Mount Calvary was carried. Energy to operate the proposed system will be furnished by the Badger Public Service Company, Plymouth.

MENOMONIE, WIS.—Plans are being prepared by the Board of Normal Regents, Capitol, Madison, for an electric power plant, to cost about $74,000. J. C. White, care state power plant, Madison, is engineer.

MOUNT CALVARY, WIS.—At an election held recently the proposal to install an electric lighting system was carried. Energy will be supplied by the Badger Public Service Company, Plymouth.

NORWALK, WIS.—The voters have approved the proposal to sell the municipal electric plant to the Wisconsin-Minnesota Light & Power Company, which will erect a transmission line from Cashton to furnish service here.

PLATTEVILLE, WIS.—The Interstate Light & Power Company is planning to extend its light and power service to farmers along the Platteville Mound Road.

PORTAGE, WIS.—Plans have been approved by the City Council for a complete water purification plant with a daily capacity of 1,500,000 gal., to include a new pumping plant, equipped with electrically operated pumps. Pearse, Greeley & Hamilton, 39 West Adams Street, Chicago, are consulting engineers.

RACINE, WIS.—Preparations are being made by the Wisconsin Gas & Electric Company for the erection of a high-tension transmission line from the Lakeside plant of the Milwaukee Electric Railway & Light Company to a point on the Durand Road west of Racine, where it expects to erect a substation to supply electricity in Racine, Franksville, Union City, Burlington and other communities in the county.

RIPON, WIS.—Plans have been completed by the Wisconsin Power, Light & Heat Company to extend its transmission line from Markeson to Dalton, passing through Kingston and Manchester, a distance of about 13 miles. An extension will also be made to Omro (6 miles) to supply electricity to a large quarry.

WILTON, WIS.—The Middle Wisconsin Power Company, Madison, is planning to extend its transmission line from Wilton to Ontario.

ST. PAUL, MINN.—The Western Fruit Express Company will install electric power equipment in connection with its proposed local car repair shop, to cost about $150,000.

WALKER, MINN.—The construction of a power plant at the local State Sanatorium is under consideration.

WINONA, MINN.—Bids will be received by the State Board of Control, Capitol, St. Paul, until Sept. 11 for construction of school building, with power plant in the basement, at the local State Teachers' College, to cost about $550,000. C. H. Johnston, Capitol Bank Building, St. Paul, is architect.

FARMINGTON, MO.—Extensions to the municipal power plant are under consideration.

HANNIBAL, MO.—Electric power equipment will be installed in the proposed local plant to be erected by the Hamilton-Brown Shoe Company, St. Louis, to cost about $125,000.

MOUNTAIN GROVE, MO.—The proposal to issue $35,000 in bonds for an electric light plant will be submitted to the voters.

SPRINGFIELD, MO.—Electric power equipment will be installed in the new local plant and elevator to be erected by the Lipscomb Grain & Seed Company, 540 Wall Street, to cost about $165,000. The Southwest Engineering Company, Woodruff Building, is engineer.

KENESAW, NEB.—The proposal to issue $15,000 in bonds for the erection of a transmission line to connect with the system of the Central Power Company, Grand Island, will be submitted to the voters.

OMAHA, NEB.—The Metropolitan Utilities Company is planning to build an addition to its electric pumping plant at Twenty-eighth Avenue and Hunt Street.

HERNDON, KAN.—An election will be held Sept. 11 to vote on the proposal to issue $30,000 in bonds for the construction of a transmission line and electric light system. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

LAWRENCE, KAN.—Plans have been prepared by the Bowersock Mill & Power Company for the installation of an electrical distribution system, to cost about $200,000. A. L. Mullegren, 555 Gates Building, Kansas City, Mo.

Southern States

CHARLOTTE, N. C.—Electric power equipment will be installed in the proposed new baking plant to be erected on West Trade Street by the American Bakeries Company, Atlanta, Ga.

ROUGEMONT, N. C.—A. Carver, it is reported, contemplates the purchase of water wheels, generator and auxiliary equipment for a local hydro-electric plant.

BREMEN, GA.—Lloyd Biggers contemplates the purchase of a waterwheel and other equipment for a local power plant.

SOUTH JACKSONVILLE, FLA.—The Leesburg Fibre Pulp & Paper Company,

Leesburg, plans to build a power house in connection with its proposed local pulp and paper mill, to cost about $500,000.

CHATTANOOGA, TENN.—The Dixie Consolidated Graphite Company, Birmingham, Ala., contemplates the construction of a power house in connection with its proposed local plant, to cost about $250,000.

WASHINGTON, LA.—Bids will be received by A. J. Muller, Mayor, until Sept. 13 for construction of an electric light plant as follows: Two 50-kw., three-phase, 60-cycle, 2,300-volt generators, directly connected to oil engines; switchboard, oil-storage tank, transformers, electric light and power distribution system; motor-driven, vertical-type service pump for water service, power house, etc. Plans are on file in the office of Sylvester Brothers, Alexandria, engineers.

McALESTER, OKLA.—Bids will be received by the city of McAlester until Sept. 18 for waterworks improvements, including two 1,400-gal.-per-minute duplex power pumps, two 1,400-gal.-per-minute centrifugal pumps, filters, filter and pump building, concrete reservoir, pipe lines, etc. E. T. Archer & Company, New England Building, Kansas City, Mo., are engineers.

FORREST CITY, ARK.—Plans have been prepared for the installation of a municipal electric plant to cost about $35,000. Eates W. Mann, Memphis, Tenn., is architect.

FRISCO, TEX.—The Fris-Co-Lina Utilities Company, recently organized to acquire power plants at Frisco and Celina, contemplates the construction of a central generating plant with transmission lines for services throughout this district.

MART, TEX.—Plans are being considered for the installation of electrically operated pumping machinery in connection with extensions to the municipal waterworks, to cost about $175,000.

Pacific and Mountain States

McGOWAN, WASH.—H. S. McGowan is planning to build a hydro-electric plant near here. The plans call for a development of 29,000 hp. at a cost of about $2,000,000.

SEATTLE, WASH.—The Municipal Power Department has secured permission to erect a transmission line across Lake Union.

VANCOUVER, WASH.—The Columbia River Paper Mill Company plans to build a power house at its new local paper and saw mill. The total cost is estimated at $1,500,000.

MARYSVILLE, CAL.—Plans are being considered for the installation of electric pumping equipment in the municipal waterworks.

OROVILLE, CAL.—The State Department of Public Works has granted Guy Wilkinson, Oroville, permission to construct a 47,650-hp. plant on the Feather River, to cost about $500,000.

SACRAMENTO, CAL.—The Sacramento Pipe Works, Seventh and R Streets, contemplates the installation of an electric traveling crane in the proposed addition to its works, to cost about $50,000.

SAN FRANCISCO, CAL.—The American Laundry Company, 3338 Seventeenth Street, plans to build a power house at its proposed plant, to cost about $100,000. Shea & Shea, Chronicle Building, are architects.

SAN FRANCISCO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 25 for 25,000 ft. of light and power wire for use at the Mare Island navy yard. (Schedule 1277.)

CHANDLER, ARIZ.—Plans are under consideration for the installation of a municipal electric distributing system for light and power service.

PHOENIX, ARIZ.—The Salt River Valley Water Users' Association is reported to have decided to proceed with the construction of the dam at Mormon Flat, to cost about $1,800,000, which will add 7,000 hp. to the capacity of the plant. The output of the Roosevelt plant will be increased by 20,000 hp.

PHOENIX, ARIZ.—Bids will soon be called by the Palo Verde River Irrigation and Power District for the construction of a 68,000-hp. hydro-electric plant, to be built in four units, and steel-tower transmission system, in connection with a large irrigation project. Holmquist & Becker, Phoenix, are consulting engineers.

YUMA, ARIZ.—The Gila Valley Power District, plans to erect a transmission line to Wellton and vicinity, with a number of new substations, to cost about $200,000. W. R. Elliott, Phoenix, is engineer.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 14, 1923)

1,465,087. SEGREGATED DRIVE FOR PAPER-MAKING MACHINES AND THE LIKE; W. L. Merrill, Schenectady, N. Y. App. filed July 12, 1922. Arrangements for establishing and automatically maintaining desired speed relation of separate driving motors.

1,465,108. UNIDIRECTIONAL RADIO RECEIVING SYSTEM; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Sept. 16, 1918. Secret radio signaling system.

1,465,173. METHOD OF ELECTRODEPOSITING COBALT AND CHROMIUM; H. C. Peffer and H. C. Pierce, Lafayette, Ind. App. filed Aug. 5, 1920.

1,465,210. SIGNAL FOR VEHICLES; W. J. Combs, Otterbein, Ind. App. filed July 21, 1922. Rear direction signal.

1,465,214. APPARATUS FOR THE FINELY GRADUATED REGULATION OF A CURRENT STRENGTH; R. Forster, Essen, Germany. App. filed Sept. 7, 1920. By closed series of resistances.

1,465,241. WELDING MACHINE; A. J. Townsend, Canton, Ohio. App. filed July 17, 1919. For spot welding.

(Issued Aug. 21, 1923)

1,465,250. TELEPHONE AND WIRLESS-TELEGRAPHY INSTALLATION; L. N. Brilluoin, Paris, France. App. filed April 25, 1918. Regulation for a given wave length by the proper selection and combination of capacities and resistances.

1,465,251. ELECTRIC MACHINE; A. B. Broluska and H. A. Broluska, Detroit, Mich. App. filed July 6, 1920. Direct current will flow without interruption or reversal through each conductor.

1,465,255. PIGTAIL CONNECTION; F. F. Dorsey, Rochester, N. Y. App. filed Oct. 19, 1921. Stranded wire coiled around end of pigtail and tamped into hole which receives pigtail.

1,465,264. ELECTRIC CONDENSER; F. G. Goldstone, Plumstead, London, England. App. filed Sept. 14, 1920. Condenser surface elements of shell or cup shape.

1,465,292. WINDOW-CLEANING APPARATUS; August Wessig, Chicago, Ill. App. filed Dec. 24, 1920. Self-contained air heating and circulating means requiring no supervision.

1,465,293. ELECTRIC LAMP; Eugen Alber, Basel, Switzerland. App. filed Dec. 10, 1919. Pocket type of glow lamp affording different degrees of brightness.

1,465,298. CORD-CIRCUIT REPEATER FOR USE BETWEEN FOUR-WIRE AND TWO-WIRE CIRCUITS; George Crisson, Hackensack, N. J., and A. F. Rose, West Brighton, N. Y. App. filed April 15, 1921. Balance provided in repeater without use of special networks.

1,465,299. LOW-FREQUENCY ALTERNATING-CURRENT SIGNALING SYSTEM; Lloyd Espenschied, Hollis, and John F. Toomey, New York, N. Y. App. filed Sept. 27, 1919. Simultaneous patch for telephonic and signaling currents, each path including selective apparatus.

1,465,301. AUTOMOBILE SIGNAL; Thomas Groves, St. Louis, Mo. App. filed Aug. 13, 1919. Two-section semaphore pivoted so either section may be rotated independently of other.

1,465,306. ELECTRICAL SWITCH; C. L. Hopkins, River Forest, Ill. App. filed Sept. 25, 1919. Improved construction in which circuit is simultaneously broken at two points.

1,465,308. SWITCH AND OVERHEAD SYSTEM; S. S. Matthes, Mansfield, Ohio. App. filed Aug. 2, 1922. Path of trolley wheel maintained at the point of crossing another conductor.

1,465,311. MEASURED-SERVICE TELEPHONE SYSTEM; W. W. Owen, Oak Park, Ill. App. filed June 14, 1919. Polarized relay used to collect or refund coin.

1,465,332. VACUUM-TUBE AMPLIFIER; H. D. Arnold, Maplewood, N. J. App. filed Sept. 3, 1915. Plurality of vacuum tubes supplied with space current from a single source.

1,465,340. APPARATUS FOR REDUCING SECONDARY RADIATION FROM ROENTGEN RAYS; A. W. Buck, St. Louis, Mo. App. filed Nov. 22, 1920. Consists of slotted diaphragm rotated between object under examination and photographic film.

1,465,344. CONDUCTOR SUPPORT; H. P. Chandler, Mansfield, Ohio. App. filed June 12, 1922. Clamping jaws for trolley wire.

1,465,352. ELECTRICAL TESTING SYSTEM; G. G. Dobson, Passaic, N. J. App. filed Sept. 27, 1920. Arrangement of balanced circuits by which measurements may be quickly and accurately made.

1,465,355. COMBINATION ELECTRIC HEATER; E. G. Eberhardt, Racine, Wis. App. filed July 22, 1922. May be used as a toaster, a hot plate and a convection type of heater.

1,465,357. RADIO COMMUNICATION; R. A. Heising, East Orange, N. J. App. filed Sept. 27, 1919. Increases the number of conversations that can be carried on simultaneously by radio.

1,465,358. SIGNALING; R. A. Heising, East Orange, N. J. App. filed Sept. 29, 1919. Interference due to waves of certain frequencies is eliminated.

1,465,360. TELEPHONE-EXCHANGE SYSTEM; G. A. E. Lundell, Chicago, Ill. App. filed Dec. 20, 1919. Slow-release relay whereby one register after the other may be rendered active in connection with the pulse circuit.

1,465,361. OPERATING MECHANISM FOR CROSS-BAR LINE SWITCHES; A. C. Magrath, Brooklyn, N. Y. App. filed Oct. 15, 1920. Unitary device sets trunk bars into operative positions and releases them after being so engaged.

1,465,368. SECRET SIGNALING SYSTEM; W. J. Shackelton, Scotch Plains, N. J. App. filed Sept. 4, 1919. Telegraph currents so small that they cannot be detected by ordinary instruments made audible by being continuously interrupted at audible frequency.

1,465,381. ELECTRODE AND ITS CONSTRUCTION; R. F. Trimble, Elizabeth, N. J. App. filed Nov. 4, 1918. Composed of two parallel U-shaped side wires, parallel cross wires extending from one U to the other and at right angles thereto.

1,465,393. TELEPHONE-EXCHANGE SYSTEM; C. L. Goodrum, New York, N. Y. App. filed Sept. 30, 1920. Two switching devices co-operate to transmit impulses for operating the switch, one being responsive to the connection of a calling substation while other is responsive only to movement of variably operable impulse sender.

1,465,394. CONTROL APPARATUS FOR EVACUATED VESSELS; W. G. Housekeeper, New York, N. Y. App. filed Nov. 6, 1920. Prevents the variations in pressure from producing fluctuations in the intensity of the electron discharge from the heated cathode.

1,465,395. TESTING CIRCUITS FOR CARRIER WAVE-SIGNALING SYSTEMS; J. S. Jammer, New York, N. Y. App. filed June 16, 1921. Test is made by disconnecting the common line with its conjugate transformer from both the transmitting circuit and receiving circuit and substituting an artificial line therefor.

1,465,410. ELECTRICAL CONNECTING DEVICE; R. B. Benjamin, Chicago, Ill. App. filed Sept. 23, 1918. Adapted to be inserted into a socket of the Edison type.

1,465,425. FIRE-ALARM APPARATUS; Vernon Durbin, Brookline, Mass. App. filed June 14, 1918. Construction and arrangement permit work of installation to be speedily and effectively accomplished.

1,465,478. ELECTRIC HEATING PLATE; Alfred Nielsen, Hovik, Norway. App. filed Sept. 6, 1922. Prevents spillage from the cooking vessel from reaching the heating wire.

1,465,489. SPRING TROLLEY EAR AND HANGER; James Scott, Cleveland, Ohio. App. filed Aug. 4, 1922. Durable resilient means of suspending a trolley wire where conditions require a relatively low suspension.

1,465,496. FIRE-ALARM SYSTEM; N. H. Suren, Needham, Mass. App. filed July 11, 1919. Immune from the transmission of false signals.

1,465,546. INDUCTANCE; H. P. Donle, Meriden, Conn. App. filed Feb. 11, 1921. A disk of insulating material having peripheral slots with a single length of wire woven back and forth through these slots.

1,465,547. ELECTRIC RESISTANCE ELEMENT; F. L. Driver, Jr., Newark, N. J. App. filed Dec. 6, 1921. Formation of "hot spots" largely eliminated and long life and high resistance to oxidation obtained by alloying 0.5 to 1.5 per cent of silicon with nickel-chromium and nickel-chromium-iron alloys.

1,465,596. DIRECTION AND STOP SIGNAL; W. D. Collins and G. W. H. Allen, Cazenovia, N. Y. App. filed March 29, 1919. Automatic as well as manual control.

1,465,615. ELECTROTHERAPEUTIC DEVICE; H. J. Nelson, Green Bay, Wis. App. filed Dec. 3, 1921. May be easily regulated without decreasing the electrical efficiency.

1,465,618. IGNITION COIL; August Toelle, Anderson, Ind. App. filed July 7, 1921. Unitary structure which may be connected to the regular engine ignition system.